

STRUCTURE OF THIS MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use this microcard		1	2	3		4
A01 = Structure of microcard					SIS	
B01 = Trouble-shooting chart	-A-	***X*	X*XXX	XXXXX	XXXXX	*XXXX X
	-B-	*XXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	C-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	D-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	E-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XX
	F-	XXXXX	XXXXX	XXXXX	XXX	
	G-	XXXXX	XXXXX	XXXX		
	H-					
	J-					
	K-					
	L-					
	M-					
N01 = Service information	-N-	*XXXX	XXXXX	XXXXX	XXX	*X XX*
		12345	67890	12345	67890	12345 678
			1		2	
						Index
N28 = Table of contents and publication information						


- 1 = Special features
- 2 = Safety and precautionary measures
- 3 = Testers and tools
- 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each micropicture).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

			
Beginning	Mid-section	End	One-page section


A01		
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HOW TO USE THIS MICROCARD

Trouble-shooting instructions for system:
Electronically controlled diesel fuel injection
Descriptions, photographs, terminal designations and special features refer to the following vehicle:

Citroen CX 25 Turbo Diesel 2
2.5l/4-cyl. engine CH,A 03.87->

These basic instructions represent detailed trouble-shooting instructions. They are not to be used as vehicle-specific instructions.
Important! Descriptions and photographs may differ from the vehicle-specific brief instructions.
Binding set values, terminal assignments and special features are to be taken exclusively from the vehicle-specific brief instructions.
For brief instructions please refer to Table of Contents Microcard KFZ-000.

A02		
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SPECIAL FEATURES

The electronically controlled diesel fuel injection system (EDC = electronic diesel control) consists of a distributor-type fuel-injection pump with built-in injected-quantity adjuster for regulating fuel delivery instead of a mechanical governor and a solenoid valve for controlling the start of delivery.

The distributor-type fuel-injection pump is actuated by two control units using microprocessor techniques. These control units process information from peripheral sensors on:

- * Air, water and fuel temperature
- * Engine speed
- * Start of injection
- * Atmospheric pressure
- * Air flow

For monitoring purposes, the EDC system is equipped with self-diagnosis as well as a safety and limp-home program.

Depending on the fault present, this program triggers immediate switch-off of the engine or it permits further, however restricted operation of the vehicle.

Faulty EDC-specific components are determined by means of their assigned flashing code.

SAFETY AND PRECAUTIONARY MEASURES

Always pay attention to stated measures so as to avoid damaging engine, control units and peripheral components of EDC.

1. Disconnect lead at electric shutoff device for testing compression.
2. When nozzle-holder assemblies are fitted with an inductive start-of-injection sensor, After-Sales-Service Centers are only allowed to correct the nozzle opening pressure.
3. Never start engine without properly connected battery.
4. Do not start engine with a fast charger. Starting aid only with second 12 V battery and auxiliary starting cable.
5. Disconnect battery from vehicle electrical system prior to boost charging.
6. Never disconnect battery from vehicle electrical system with engine running.
7. Never detach or connect control-unit plug with ignition switched on.
8. Remove control units at temperatures in excess of +80°C (drying stove).
9. Remove control units when performing welding work (electrical spot welding).

Safety and limp-home program

Fault / Limp-home measure

1. Injected-quantity adjuster defective:
Engine is switched off by electric shutoff device
2. Timing device defective:
Delivery is limited.
3. Air-flow sensor defective:
Fixed value for air flow, no exhaust gas recirculation.
4. EGR actuator defective:
Delivery is limited, EGR disconnected.
5. Accelerator-pedal sensor defective:
Engine runs at a constant speed
(e.g. 1270 min⁻¹)
6. Engine-speed sensor defective:
Determination of substitute speed from start-of-injection signal.
EGR is disconnected.
Start of injection is controlled, quantity of fuel injected is reduced, max. engine speed is limited and idling speed increased.
7. Needle-motion sensor defective:
Delivery is limited and start-of-injection controlled.

Safety and limp-home program (continued)

8. Temperature sensor (coolant) defective: *
Control unit makes use of substitute values and exhaust gas recirculation is disconnected.
9. Temperature sensor (air) defective: *
Control unit makes use of substitute values and exhaust gas recirculation is disconnected.
10. Temperature sensor (fuel) defective: *
Control unit makes use of substitute values.
11. Control-collar travel sensor defective:
Engine stopped, injected-quantity adjuster is switched off.
12. Charge-air pressure/atmospheric pressure sensor defective: *
No altitude correction for exhaust gas recirculation.
13. Computer link (control unit) defective:
Full-load delivery is reduced.
Control unit makes use of substitute values.
14. Computer monitoring (control unit) defective:
Control unit 1 defective:
Injected-quantity adjuster is switched off.
Control unit 2 defective:
Start-of-delivery solenoid valve deenergized, exhaust gas recirculation is switched off.

N o t e :

* = Slight faults; indicator lamp of self-diagnosis goes out 30 seconds following start of engine.

TESTERS AND TOOLS

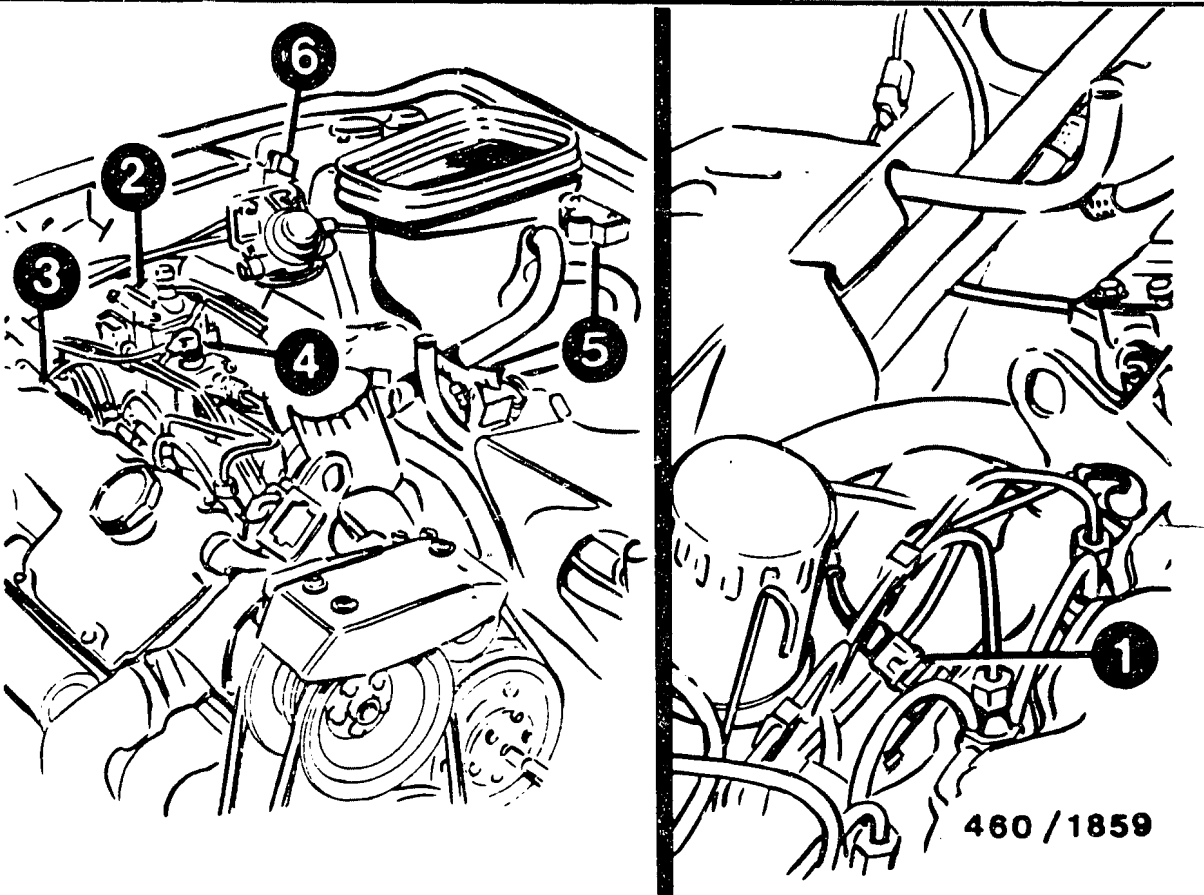
Designation	Part No.	Application
Citroen special tool	Citroen 5003-T.A.	-Removal of valve spring (engine) -Pump/engine assignment
Pressure measuring device or pressure gauge 0...1.6 bar	KDJE-P 100 e. g. Wika No. 4 184	Testing charge-air pressure
Box wrench	KDEP 1115	Loosening/tightening fuel-injection tubing
Measuring device	KDEP 1085	Pump/engine assignment
Adapter for measuring device	KDEP 1127	Pump/engine assignment
Mini dial indicator Scale division 1/100 mm	Commercially available e.g. Hahn & Kolb D-7000 Stuttgart Part No. 33 003	Pump/engine assignment
Vacuum hand pump "Mityvac"	Korinth Co. Ludwig-Kloos-Straße 21 D-6450 Hanau 7 (Steinheim)	Testing EGR valve and throttle-valve intake air
Citroen special tool	Tool -K- from tool kit OUT 206 028 T	Detaching belt sprocket of fuel-injection pump

TESTERS AND TOOLS (continued)

Designation	Part No.	Application
Nozzle tester	EFEP 60 H 0 681 200 502	Testing injection nozzles
Compression tester	Commercially available	Testing engine compression
Compression-loss tester	EFAW 210 A 0 681 001 901	Testing engine compression loss
Tachometer	Commercially available, e.g. Dr. E. Horn GmbH Meßgerätefabrik Postfach 40 D-7036 Schönaich Order designation: HT 446 (with digital display)	Checking engine speed
Differential-pressure device	Commercially avail., Part No. NG 160/311-911 -1.0 + 4.0 bar Haenni Co. Nauheimerstraße 78-80 7000 Stuttgart 50	Filter testing
Evaluating unit Set of accessories with sampling pump	0 684 102 050 0 681 169 038 or 0 681 169 058	Smoke testing

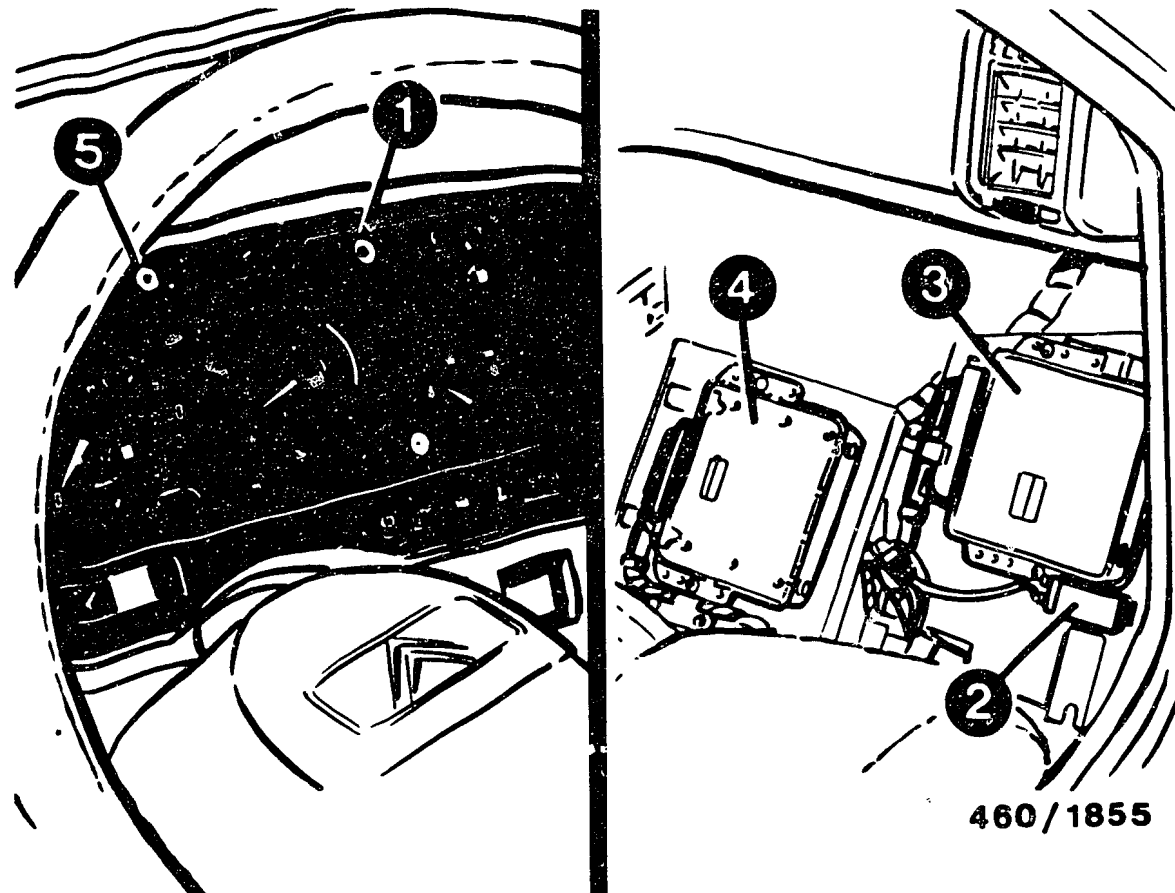
TESTERS AND TOOLS (continued)

Designation	Part No.	Application
Test adapter	KDEP 1165	Testing EDC system
Adapter lead for KDEP 1165	KDEP 1165/200 -201	Testing EDC system
Evaluation unit for flashing-code diagnosis	KDAW 9980	Stimulation and evaluation of self-diagnosis
Test lead	KDZS 0004 0005	Testing EDC system
Test lead	KDUM 0007 0008	Testing EDC system
Test lead	Commercially available Pin terminal on either end 4 mm diameter	Testing EDC system
Multimeter e.g. digital multimeter	Bosch MMD 301 0 684 500 301	Testing EDC system
Motortester e.g. MOT 201/206 300 400/401 501	0 684 000 201/206 0 684 000 300 0 684 000 400/401 0 684 000 501	Testing EDC system
VA-tester	ETT 011.00 0 684 101 100	Testing preheating system



- 1 = Temperature sensor (coolant)
- 2 = Fuel-injection pump
- 3 = Nozzle-holder assembly with needle-motion sensor
- 4 = Electric shutoff unit
- 5 = Atmospheric pressure sensor
- 6 = Vacuum pump

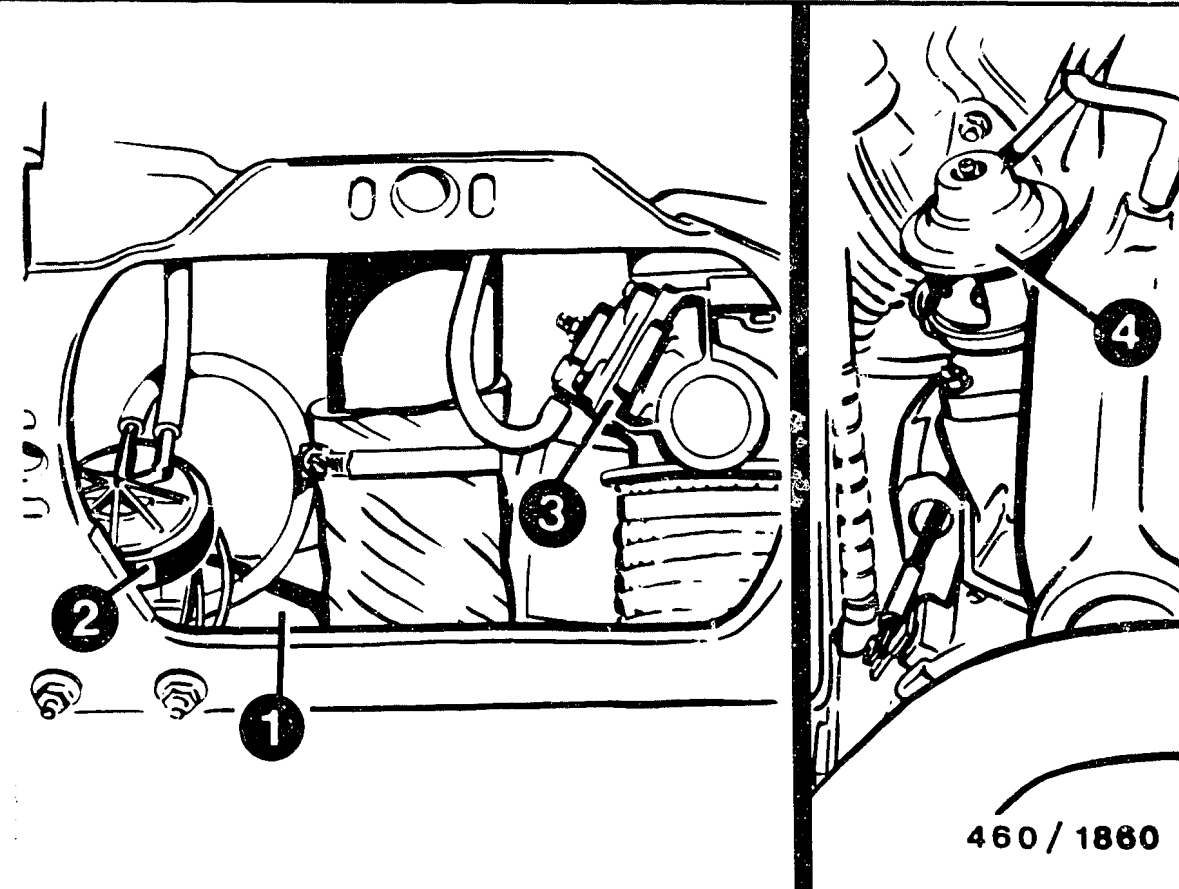
INSTALLATION POSITION OF COMPONENTS



460/1855

- 1 = Diagnosis indicator lamp
- 2 = Reverse-polarity protection relay with reverse-polarity protection diode
- 3 = Delivery and road-speed control unit (designated control unit 1 and control-unit plug 1 in these trouble-shooting instructions)
Installation location: beneath glove compartment
- 4 = Start-of-delivery and EGR control unit (designated control unit 2 and control-unit plug 2 in these trouble-shooting instructions)
Installation location: passenger-side footrest
- 5 = Water-level-sensor display

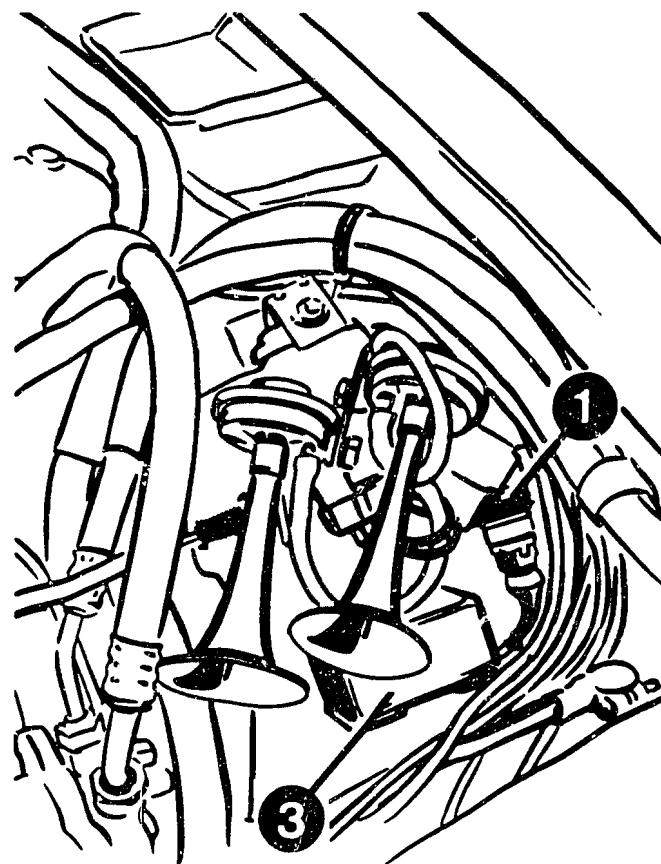
INSTALLATION POSITION OF COMPONENTS (continued)



460/1860

- 1 = Air-flow sensor with air filter
- 2 = Pressure transducer (EGR)
- 3 = Throttle-valve assembly
- 4 = Exhaust gas recirculation valve (EGR)

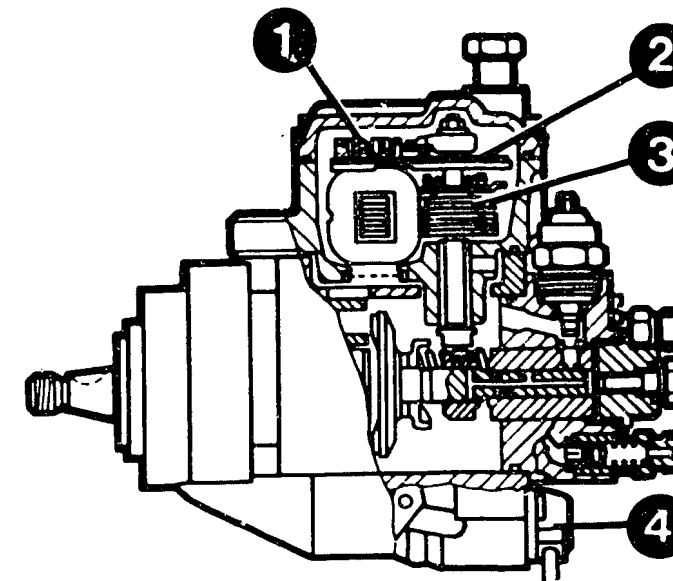
INSTALLATION POSITION OF COMPONENTS (continued)



460 / 1861

- 1 = Accelerator-pedal sensor
- 2 = Engine-speed sensor
- 3 = Glow-duration unit

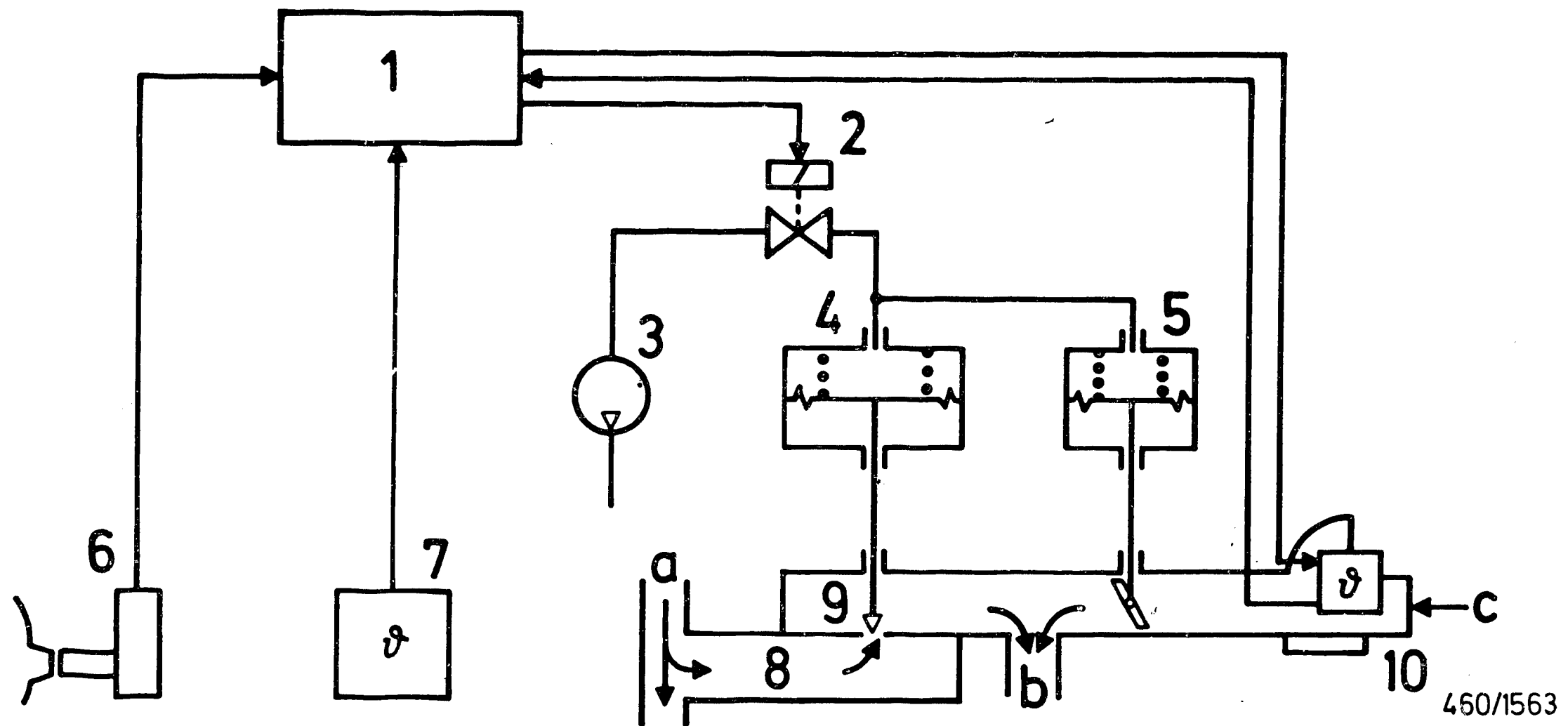
INSTALLATION POSITION OF COMPONENTS (continued)



460 / 1862

- 1 = Temperature sensor (fuel)
- 2 = Control-collar travel sensor
- 3 = Injected-quantity adjuster
- 4 = Solenoid valve (start of injection)
- 5 = Temperature sensor (air)

INSTALLATION POSITION OF COMPONENTS (continued)

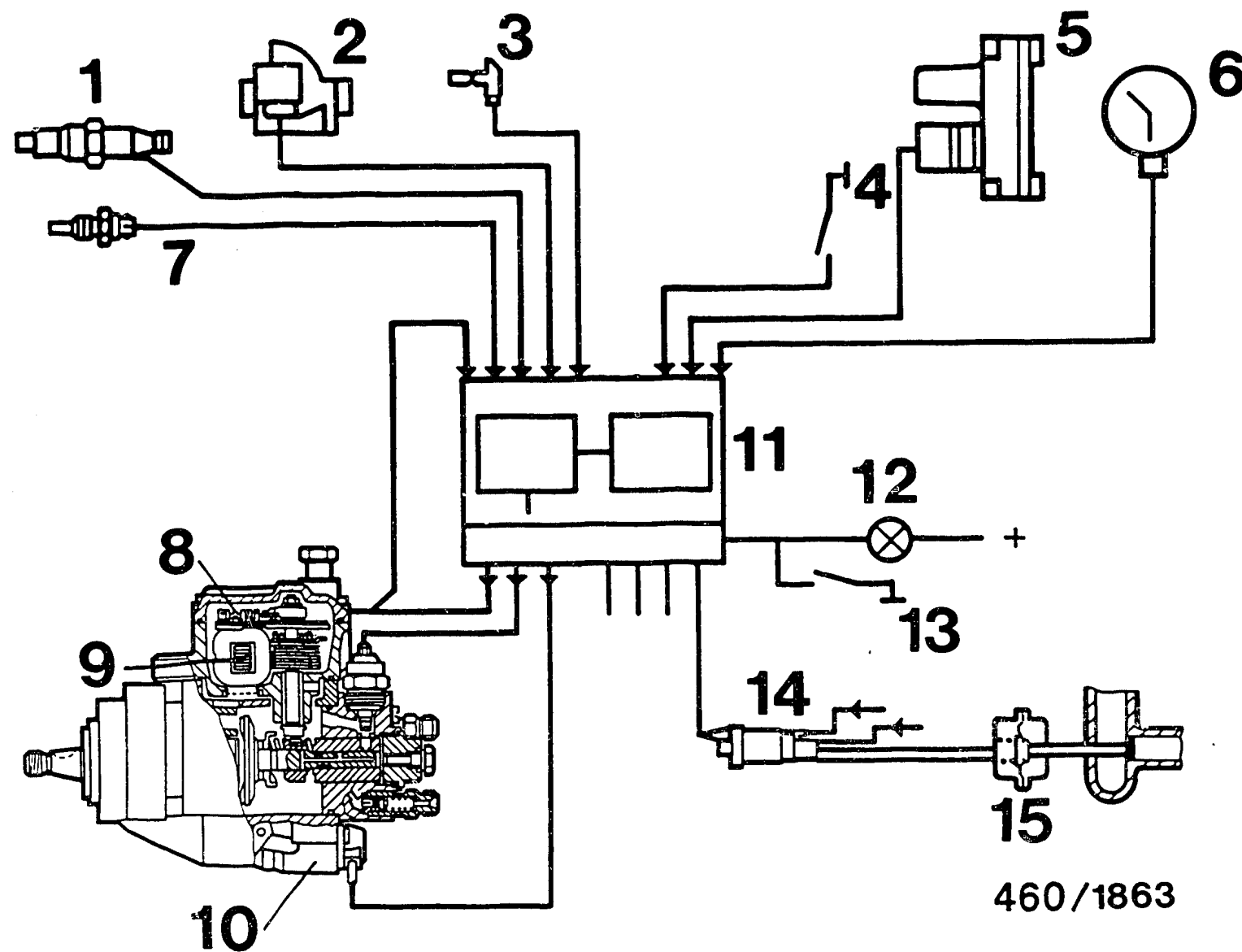


- 1 = Start-of-injection and exhaust-gas-recirculation control unit
- 2 = Exhaust-gas-recirculation actuator
- 3 = Vacuum pump
- 4 = Exhaust-gas-recirculation valve
- 5 = Throttle-valve assembly
- 6 = Engine-speed sensor
- 7 = Temperature sensor (coolant)

- 8 = Exhaust pipe
- 9 = Charge pipe
- 10 = Air-flow sensor

- a = Engine exhaust gas
- b = Engine intake air
- c = Fresh air

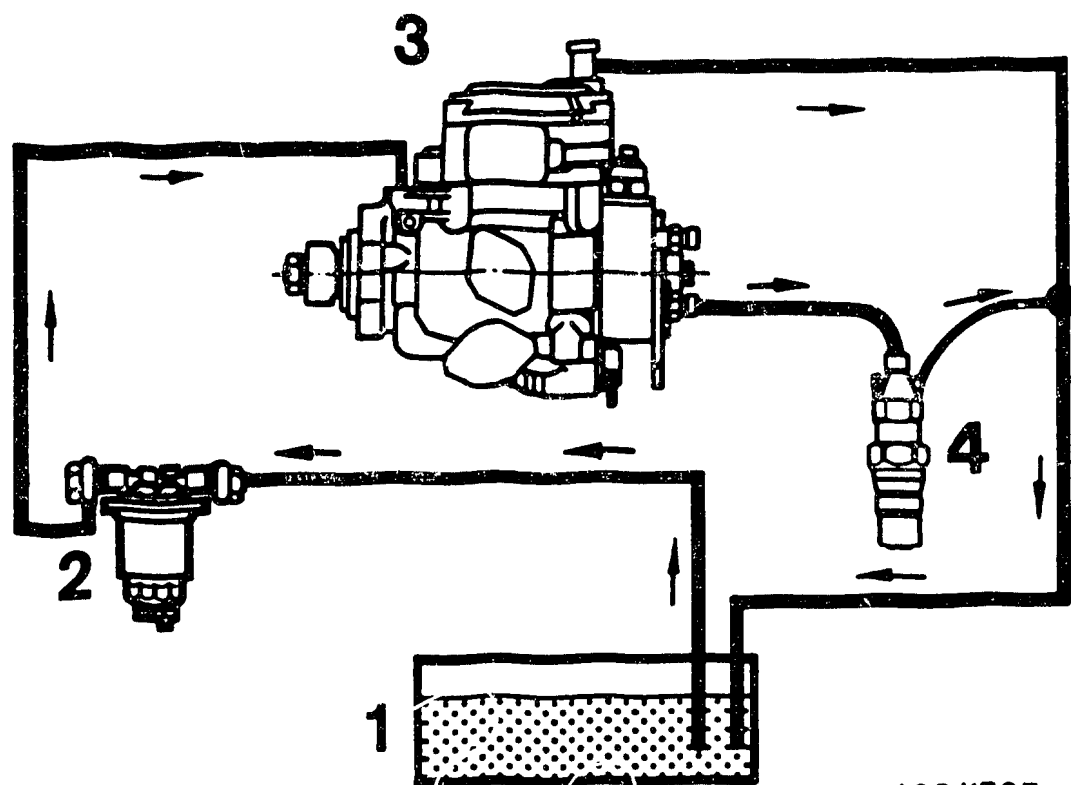
OVERVIEW OF CONTROLLED EXHAUST GAS RECIRCULATION (EGR)



- 1 = Nozzle-holder assembly with needle-motion sensor
- 2 = Air-flow sensor with temperature sensor (air)
- 3 = Engine speed/reference mark sensor
- 4 = Switch (brake)
- 5 = Charge-air-pressure/atmospheric-pressure sensor
- 6 = Accelerator-pedal sensor
- 7 = Temperature sensor (coolant)

- 8 = Temperature sensor (fuel)
- 9 = Injected-quantity adjuster
- 10 = Solenoid valve (start of injection)
- 11 = Control units
- 12 = Diagnosis display
- 13 = Flashing-code prompt
- 14 = Electropneumatic pressure transducer (EGR)
- 15 = EGR valve

SYSTEM OVERVIEW - EDC - Citroen CX 25 Diesel Turbo 2



460/1565

- 1 = Fuel tank
- 2 = Fuel filter
- 3 = Distributor-type fuel-injection pump
- 4 = Injection nozzles

DIAGRAM OF FUEL LINES

The fuel lines are connected in accordance with the diagram above.

The fuel flows in the direction of the arrow.

For production reasons:
continued on the following
coordinate.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts with Coordinate B06 and contains customer complaint (fault symptom/fault characteristic feature) together with several possible causes in each case (component faults) and coordinate information for detailed trouble-shooting. If no coordinates are given, this is because the causes concerned do not require any test instructions.

In the event of a clearly established customer complaint, proceed consecutively and step by step as indicated in the trouble-shooting instructions in the stated sequence of possible causes.

Trouble-shooting should always be commenced with self-diagnosis (if provided) or with the universal test adapter (if envisaged). Only then should trouble-shooting be continued in line with the trouble-shooting chart.

In the event of a customer complaint which is not clear-cut, all causes indicated in the trouble-shooting chart must be tested. In order to avoid incorrect measurements, all causes are to be checked in the specified sequence (on account of interlinkage of test steps).

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

The TROUBLE-SHOOTING PROGRAM contains all system and component tests indicated in the trouble-shooting chart. It is sub-divided into three rows of boxes.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and fault elimination.

The right-hand column contains pictures/connection diagrams linked to the text together with explanatory notes.

If the questions posed in the left-hand column can definitely be answered with "yes", trouble-shooting is to be continued with the next box below.

If the answer to the question is "no", the center column must be applied and the tests performed in the sequence indicated there.

Following fault elimination, repeat test as a check.

TEST PREREQUISITES:

- Battery fully charged
- Engine in proper mechanical working order (e.g. compression, valve clearance etc.)
- Engine at operating temperature of approx. +80°C (if necessary)
- Proper connection of all connectors of wiring harness

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM

The control units of the electronically controlled diesel fuel injection system (EDC = electronic diesel control) feature a self-diagnosis system for detecting defective peripheral components/conduction paths.

Self-diagnosis should therefore always be the first step when performing trouble-shooting (testing).

If several faults can be called up one after the other via the self-diagnosis, note down flashing codes indicated. In the event of an interruption in the voltage supply for the control units, the stored faults are cleared. This means that non-current faults (e.g. occasional faults such as loose contacts) cannot be interpreted as the cause of the malfunction.

If a faulty function path is indicated, particular attention is to be given to the following:

- * Loose contacts at multiple plug connections
- * Dirty, pushed-back or corroded plug contacts
- * Breaks in leads where leads are kinked or crushed.

Note:

Always switch off ignition before detaching or connecting control-unit plugs.

Clear stored fault flashing code after performing repairs and trigger self-diagnosis again as a check.

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (CONTINUED)

Self-diagnosis by way of flashing-code evaluation is described as of Coordinate B10.

The self-diagnosis test starting as of Coordinate B15 contains the following:

- fault indication (flashing code)
- components or system functions checked
- test instructions/test conditions
- terminals
- set values
- indication of coordinates for trouble-shooting and fault elimination in subsequent self-diagnosis trouble-shooting program

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (CONTINUED)

The self-diagnosis trouble-shooting program is split up into 3 columns as of Coordinate E27.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and fault elimination.

The right-hand column contains pictures/terminal diagrams belonging to the text together with explanatory notes.

If the questions posed in the left-hand column can definitely be answered with "yes", trouble-shooting is to be continued with the next box below.

If the answer to the question is "no", the center column must be employed and the tests performed in the sequence indicated there.

If the self-diagnosis indicates a fault, but there is no system or component fault, the control unit is to be replaced.

If no further system-specific faults are indicated by the self-diagnosis and the customer complaint (fault symptom) has still not been eliminated, trouble-shooting must be continued with the trouble-shooting chart as of Coordinate B06.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Diagnosis lamp lights up/flashes
2. Starting motor operates, engine fails to start or starts only with difficulty (hot and cold)
3. Engine hunts when idling
4. Idle not smooth with hot engine
5. High fuel consumption in conjunction with inadequate engine power and formation of smoke
6. Inadequate performance
7. Black smoke in full-load range in conjunction with hard engine running and possible lack of power
8. Hard engine running

						Cause (component fault)	Coord.
*						Self-diagnosis	B10
*						Control-unit supply	E17
*						Injected-quantity adjuster	C21
*						Control-collar travel sensor	C13
*						Electric shutoff device	F13
*			*	*		Computer monitoring	E13
			*	*		Solenoid valve (start of injection)	D25
			*			Electropneumatic pressure transducer (EGR)	D09
			*			Nozzle-holder assembly with needle-motion sensor	D19
			*			Computer link	E09
	*			*		Engine-speed sensor	D13
*						Engine-speed sensor and needle-motion sensor	D13/ D19
*						Tank empty, tank ventilation	F16
*	*			*		Injection sequence not firing sequence	F15

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

1. Diagnosis lamp lights up/flashes
2. Starting motor operates, engine fails to start or starts only with difficulty (hot and cold)
3. Engine hunts when idling
4. Idling not smooth with hot engine
5. High fuel consumption in conjunction with inadequate engine power and formation of smoke
6. Inadequate performance
7. Black smoke in full-load range in conjunction with hard engine running and possible loss of power
8. Hard engine running

Cause (component/fault)						Coord.
*					Supply/return inlet-union screws	F22
*	*				Air in fuel system	F17
*					Paraffin separation	F19
*		*			Leakage in fuel lines	F22/ F24
*					Supply lines clogged	F24
*	*	*	*	*	Injection nozzle	G08
*	*	*	*		Pump/engine assignment	H20
*					Fuel filter	F19
*					Preheating system	E27
*	*	*			Engine compression	G20
*	*	*	*	*	Fuel-injection pump	H04
		*			Engine air filter	F25
		*			Engine management	H12
				*	Timing device	G19
			*		Turbocharger	H21

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9. Engine missing when driving
10. Engine switches off automatically
11. Engine runs at constant speed
12. Engine won't rev up when cold
13. High idle or rough engine running at high engine speed
14. Black smoke in full-load range
15. Cloudy white fumes in full-load range

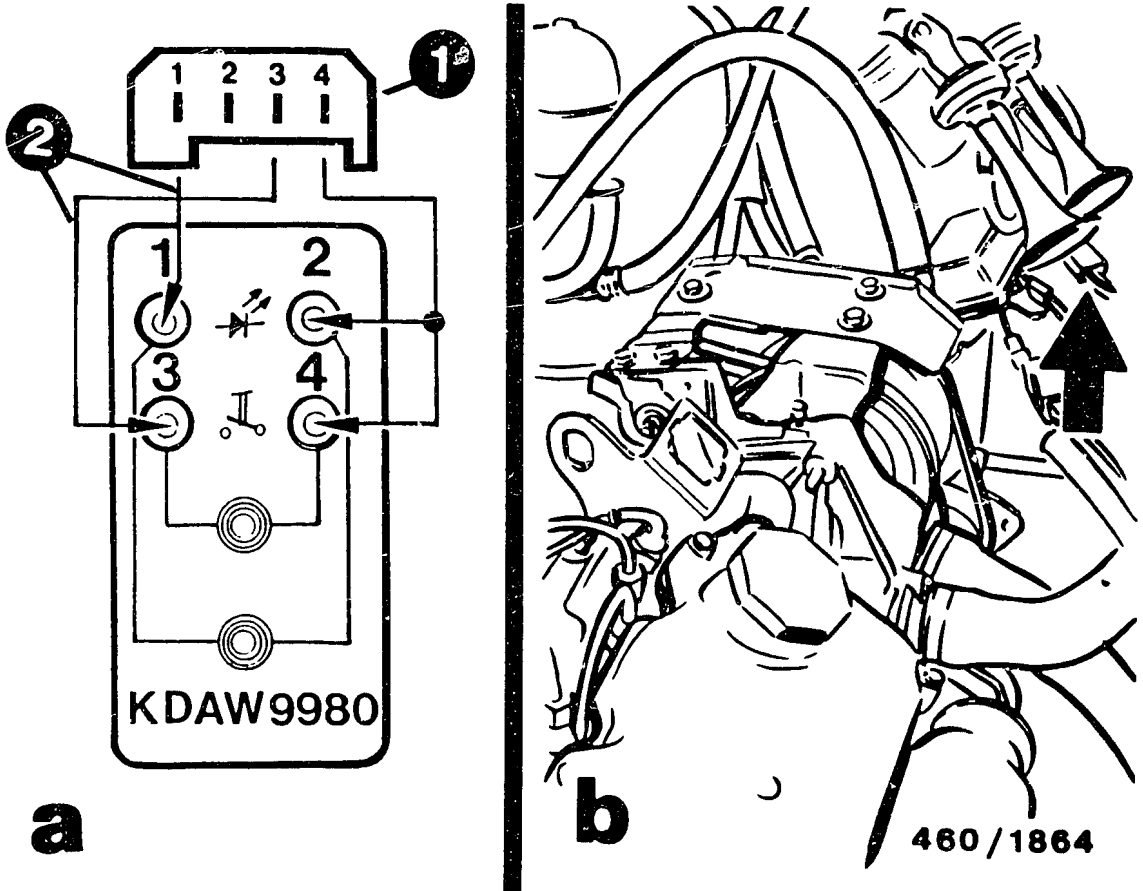
Cause (component fault)						Coord.
	*				Accelerator-pedal sensor	C09
*					Injected-quantity adjuster	C21
*			*		Control-collar travel sensor	C13
*					Computer monitoring	E13
*					Engine-speed sensor and needle-motion sensor	D13/ D19
*	*		*		Tank empty, tank ventilation	F16
	*		*		Injection sequence not firing sequence	F15
*			*		Supply/return inlet-union screws	F22
*			*		Air in fuel system	F17
			*		Paraffin separation	F19
*					Leak in fuel lines	F22/ F24
*			*		Supply lines clogged	F24
			*		Pump/engine assignment	H18
			*		Fuel filter	F19
			*		Engine compression	G20
			*		Fuel-injection pump	H04
				*	Exhaust gas recirculation	E23
*					Water level sensor	F21

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

16. No EGR function
17. Black smoke in full-load range in conjunction with hard engine running and possible loss of power
18. Starting motor operates, engine fails to start or starts only with difficulty (cold or hot)
19. No fault storage

					Cause (component fault)	Coord.
*					Computer monitoring	F13
*					Solenoid valve (start of injection)	D25
*					Electropneumatic pressure transducer (EGR)	D09
*					Nozzle-holder assembly with needle-motion sensor	D19
*					Engine-speed sensor	D13
*					Air-flow sensor	D01
*					Temperature sensor (air)	C01
*					Temperature sensor (coolant)	C03
*	*				EGR valve	E23
		*			Switch (brake)	E21



- 1 = Diagnosis plug
- 2 = Connecting leads KDUM 0007

SELF-DIAGNOSIS VIA FLASHING-CODE EVALUATION

An integrated self-diagnosis system in both control units (output only via control unit 2) makes it possible to localize a faulty component or conduction path by way of a flashing code. An indication is likewise given via a lamp in the instrument panel which lights up or flashes in the event of a fault.

The diagnosis program is activated by way of stimulation using the flashing-code evaluation unit KDAW 9980 (picture a) at the diagnosis plug (picture b, arrow).

The program then starts with the start code 1.2 (= 1 flashing pulse – pause – 2 flashing pulses) and ends with the end code 1.1.

Self-diagnosis by way of flashing-code evaluation (continued)

The flashing pulses indicated between the start and end codes are an indication of the faulty function path.

If there is no fault, the indicator lamp goes out as soon as the engine is running. In other words as soon as engine-speed pulses are present.

In the event of a minor fault (e.g. temperature sensor (air) defective), the indicator lamp goes out approximately 30 seconds after starting the engine. Within this period, the driver is given an indication of both current faults and stored faults. Once the indicator lamp has gone out, the corresponding flashing code can be called up again by stimulating the self-diagnosis.

In the event of severe faults, the indicator lamp remains continuously lit after starting the engine. The indicator lamp is, however, only actuated for as long as the fault is a current one (no indication of stored faults).

If there are several faults present at the same time, they can be called up one after the other. Detected faults are stored, i.e. even limited-time faults (e.g. loose contact at multiple butt connector) are not cancelled after switching off the ignition.

Note :

Stored self-diagnosis faults are cleared if the voltage supply for the control units is interrupted.

* Breakdown of self-diagnosis (Flashing code)

- 1.1 End of program code
- 1.2 Start of program code
- 1.3 Temperature sensor (air)
- 1.4 Temperature sensor (coolant)
- 1.5 Temperature sensor (fuel)
- 2.1 Accelerator-pedal sensor
- 2.2 Control-collar travel sensor
- 2.3 Injected-quantity adjuster
- 3.1 Atmospheric pressure sensor
- 3.3 Air-flow sensor
- 3.4 EGR pressure transducer
- 4.1 Engine-speed sensor
- 4.2 Needle-motion sensor
- 4.3 Solenoid valve (start of delivery)
- 5.1 Computer-link control unit
(stored fault)
- 5.2 Computer-link control unit
(current fault)
or computer monitoring -
control unit 1

Lamp continuously lit (no flashing code can be called up)

Computer monitoring - control unit 2

Note :

Stored self-diagnosis faults are cleared if the voltage supply for the control units is interrupted.

Flashing-code evaluation

1. Switch on ignition.
2. The self-diagnosis must be stimulated for at least 1 second so as to avoid incorrect triggering.
3. Start code 1.2 of diagnosis program is indicated.
4. Wait until indicator lamp lights up again, then repeat stimulation process.
5. Flashing code of corresponding faulty component is indicated.
6. Repeat stimulation. If there are no further faults present, the end code 1.1 is indicated.

Flashing-code cancellation

1. Switch on ignition.
2. Depress brake pedal and simultaneously carry out stimulation of self-diagnosis for at least 1 second.
3. Call up diagnosis program again by stimulating self-diagnosis.
4. If the end code 1.1 is indicated following the start code 1.2, then the stored flashing code for the respective faulty component has been cancelled.

Testing self-diagnosis:

Switch on ignition:

Indicator lamp (instrument panel) must light up.

Stimulate self-diagnosis:

Start code 1.2 and end code 1.1 must be indicated.

In the event of a malfunction, carry out following tests:

1. Test bulb and replace if necessary.
2. Check for open-circuit in following leads:
 - * Control unit 2 term. 21 - indicator lamp
 - * Indicator lamp - reverse-polarity protection relay
 - * Diagnosis plug term. 4 - control unit 2 term. 21
 - * Diagnosis plug term. 3 - ground

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/test conditions	Termi- nals	Set values	Coor- dinate
1.3	Temperature sensor (air)	Test resistance at air-flow sensor at 15...20°C at approx. 80°C Test measuring-circuit voltage (control unit) at detached connector.	1 - 4 1 - 4	1300...3600 Ω 250...390 Ω Approx. 5 V	C01
1.4	Temperature sensor (coolant)	Test resistance at component. 15...30°C: approx. 80°C: Test measuring-circuit voltage (control unit) at detached connector.		1300...3600 Ω 250...390 Ω Approx. 5 V	C03
1.5	Temperature sensor (fuel)	Perform tests at 7-pole connector of EDC distributor-type fuel-injection pump using test adapter KDEP 1165 and adapter leads KDEP 1165/200 and -/201. * Short-circuit to ground Connect adapter to fuel-injection pump connector * Short-circuit Connect adapter to fuel-injection pump connector * Internal resistance at 15...30°C: Connect adapter to fuel-injection pump connector * Measuring-circuit voltage (control unit): Connect adapter to control-unit connector	5-grnd. 6-grnd. 4 - 6 5 - 6 5 - 6	> 1 M Ω > 1 M Ω > 1 M Ω See brief instruc. 4.5...5.5 V	C05
2.1	Accelerator-pedal sensor	Perform tests at component. * Internal resistance * Supply voltage * Voltage signal-idle -full load	1 - 3 1 - 3 (-) (+) 1 - 2 1 - 2	See brief instruc. 4.5...5.5 V See brief instruc. See brief instruc.	C09

SELF-DIAGNOSIS TEST TABLE (continued)

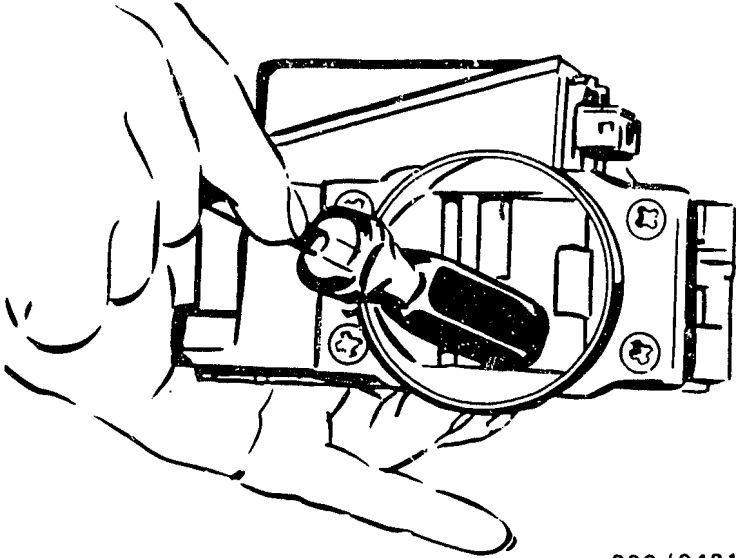
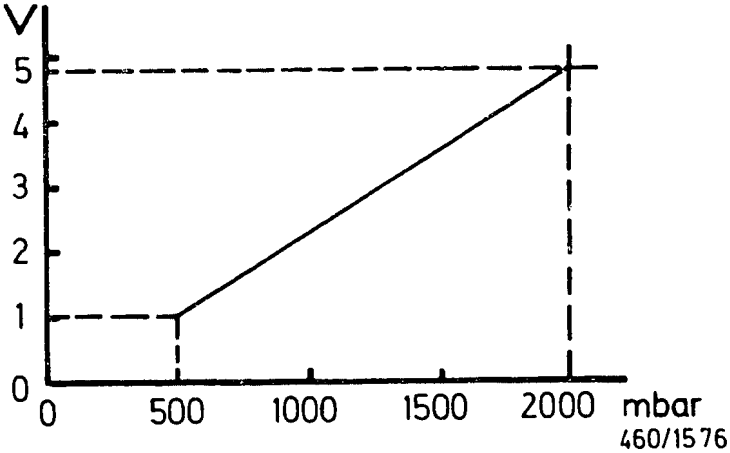
Fault indication Flashing code	Testing of component/function	Test instructions/test conditions	Termi- nals	Set values	Coor- dinate
2.2	Control-collar travel sensor	<p>Perform tests at 7-pole connector of EDC distributor-type fuel-injection pump using test adapter KDEP 1165 and adapter leads KDEP 1165/200 and -/201.</p> <p>* Short-circuit to ground Connect adapter to fuel-injection pump connector</p> <p>* Short-circuit Connect adapter to fuel-injection pump connector</p> <p>* Resistance - potentiometer track Connect adapter to fuel-injection pump connector.</p> <p>* Resistance - wiper track Connect adapter to fuel-injection pump connector.</p> <p>* Supply voltage Connect adapter to control-unit connector.</p> <p>* Voltage signal Connect both connectors to adapter. Disconnect connecting lead to needle-motion sensor.</p> <p>* Attach connector to needle-motion sensor.</p>	<p>1-grnd. 2-grnd. 3-grnd.</p> <p>2 - 7</p> <p>2 - 3</p> <p>1 - 3</p> <p>2 - 3 (+) (-)</p> <p>1 - 3</p>	<p>> 1 M Ω > 1 M Ω > 1 M Ω</p> <p>> 1 M Ω</p> <p>See brief instructions</p> <p>See brief instructions</p> <p>4.5...5.5 V</p> <p>See brief instructions</p> <p>See brief instructions</p>	C13

SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function	Test instructions/test conditions	Termi- nals	Set values	Coor- dinate
2.3	Injected-quantity adjuster	Perform test at 7-pole connector of EDC distributor- type fuel-injection pump using test adapter KDEP 1165 and adapter leads KDEP 1165/200 and -/201. * Short-circuit to ground Connect adapter to fuel-injection pump connector. * Internal resistance Connect adapter to fuel-injection pump connector. * Supply voltage Connect adapter to control-unit connector.	4-grnd. 7-grnd. 4 - 7 7-grnd.	> 1 M Ω > 1 M Ω See brief instructions 8.5...14.5 V	C21

SELF-DIAGNOSIS TEST TABLE (continued)

Fault indic. Flash. code	Testing of component/ function Test instructions/test conditions	Termi- nals	Set values	Coor- dinate
3.1	Atmospheric pressure sensor. Perform test at component. * Supply voltage * Voltage signal (Determine barometer reading)	1 - 3 1 - 2	4.5...5.5 V See characteristic curve	C25
3.3	Air-flow sensor. Perform tests at component. * Total resistance * Supply voltage * Voltage signal - By changing position of sensor flap of air-flow sensor * Noise test - Motortester, special input	3 - 4 3 - 4 (+) (-) 2 - 4 2 - 4	See brief instruc. 4.5...5.5 V See brief instruc. Noise signal with faulty air-flow sensor (see picture)	D01
3.4	EGR pressure transducer * Test internal resistance at component at 0...120°C * Test measuring-circuit voltage (control unit) at connector component * Actuation on/off ratio - Cooling-water temperature approx. 80°C - Connect pocket tester to pressure transducer - Set dwell-angle range - Run engine at idle speed - Detach connector at cooling-water temperature sensor or air-flow sensor. Test instruction: On/off ratio must change when one of the components is detached.	1-grnd.	4.5...8.0 Ω Approx. 12 V Read off on/off ratio from tester See brief instructions	D09



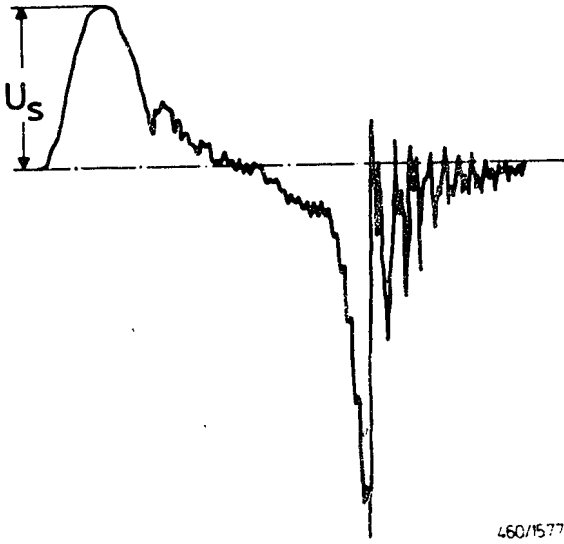
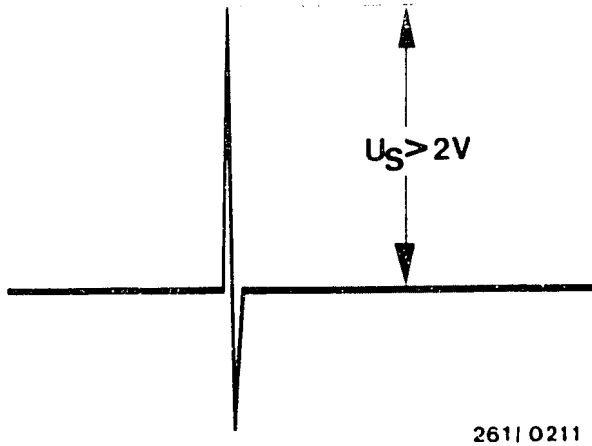
280 / 0481



- 280/0264

SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function Test instructions/test conditions	Termi- nals	Set values	Coor- dinate
4.1	Engine-speed sensor Perform tests at multiple butt connector of component. * Short-circuit to ground * Internal resistance at approx. 20°C * Engine-speed signal pattern - Motortester, special input - Run engine at idle speed Note: Positive voltage peak must come first	 1 - 2 1 - 2 (+) (-)	 > 1 M Ω See brief instructions See signal pattern	D13
4.2	Perform needle-motion-sensor tests at multiple butt connector of component. * Short-circuit to ground * Internal resist. approx. 20° C approx. 80° C * Supply voltage - Mult. butt connector detached - Multiple butt connector attached at approx. 80°C * Needle lift signal/signal voltage (U_s) - Multiple butt connector attached - Run engine at idle speed - Motortester, special input		> 1 M Ω See brief instruc. See brief instruc. See brief instruc. See brief instruc. See signal pattern U_s = See brief instructions	D19



SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function	Test instructions/test conditions	Set values	Coord.
4.3	Solenoid valve (start of injection)	Perform tests at multiple butt connector of component. * Short-circuit to ground * Internal resistance at approx. 60°C * Test measuring-circuit voltage (control unit) at detached multiple butt connector. * Actuation on/off ratio - Cooling-water temperature approx. 80° C - Connect pocket tester to connected multiple butt connector - Set dwell-angle range - Run engine at idle speed - Detach connector at needle-motion sensor - Attach connector to needle-motion sensor Test instruction: On/off ratio must change when needle-motion-sensor plug is detached or engine speed is increased.	> 1 M Ω See brief instruc. Approx. 12 V See brief instruc. See brief instruc.	D25
5.1	Computer link Control unit (Stored fault)	Fault is not present when test performed. Detach control-unit plugs 1 and 2. Test leads listed below for open-circuit and contact resistance: <div style="margin-left: 100px;"> Control-unit plug 1 Control-unit plug 2 Term. 14 to term. 9 Term. 15 to term. 12 </div>	Approx. 0 Ω	E05

SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function	Test instructions/test conditions	Termi- nals	Set values	Coordi- nates
5.2	Computer link Control unit (Current fault)	Fault present when test performed. Detach control-unit plugs 1 and 2. Test leads listed below for open-circuit and contact resistance: Control-unit plug 1 Control-unit plug 2 Term. 14 to term. 9 Term. 15 to term. 12		+/- 0 Ω	E09
5.2	Computer monitoring Control unit 1	There is a fault in the computer monitoring only if the engine c a n n o t be started when the flashing code is indicated. Renew control unit 1.			E13
Continuously lit	Computer monitoring Control unit 2	Indicator lamp of self-diagnosis lights up constantly and n o flashing code is indicated when test switch is actuated. EGR disconnected. Disconnect multiple butt connector of solenoid valve (start of injection). Test measuring-circuit voltage (control unit) at multiple butt connector.		+/- 12 V	E15

SELF-DIAGNOSIS TEST PROGRAM (1)

Flashing code : 1.3

Component:
Temperature sensor (air)
(top picture - arrow)

Test 1: Resistance

Detach connector at air-flow
sensor.

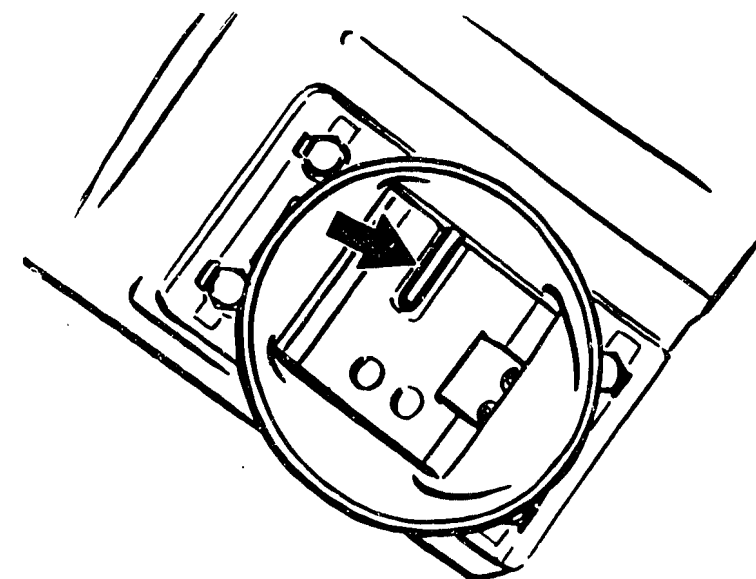
Connect multimeter with test leads
KDUM 0008 to air-flow sensor term. 1
and term. 4 (center picture).

Set value:
at 15...30° C:
1.3...3.6 k Ω

Set value attained?

N>

Intake-air temperature sensor
defective, replace air-flow
sensor.



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Test 2: Measuring-circuit voltage
Control unit

Connect multimeter with test leads
KDZS 0004 to connector term. 1 and
term. 4.

Switch on ignition.

Set value: approx. 5 V

Set value attained?

N>

Switch off ignition.

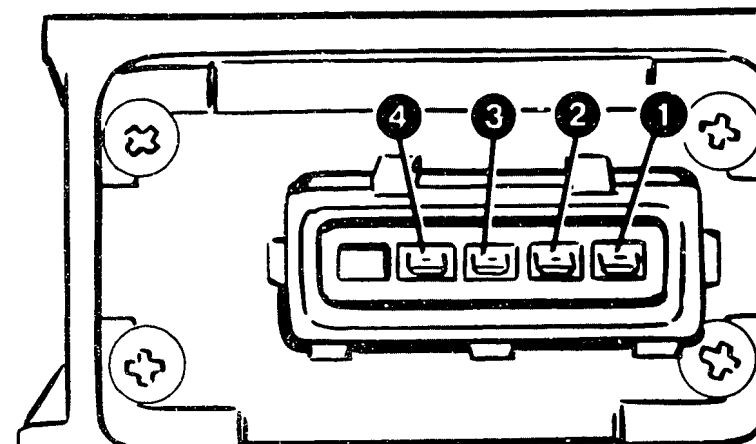
Disconnect control-unit plugs
1 and 2.

Test leads term. 4 at control-
unit plug 2 and term. 26 at
control-unit plug 1 (lower
illustration) to air-flow
sensor with test leads KDZS 0004
for open circuit and/or contact
resistance.

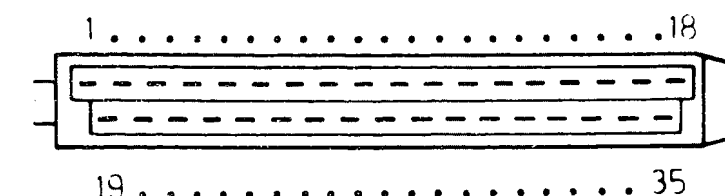
Bridge leads term. 1 and term. 4
at cable connector of air-flow
sensor.

Set value: approx. 0 Ω

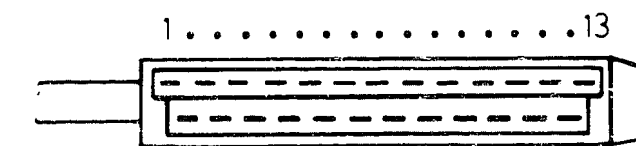
If set value is obtained,
replace control unit 1.



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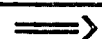
19 35



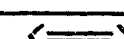
14 25 460/1570

Return to self-diagnosis
test table B15

C01



C02



SELF-DIAGNOSIS TEST PROGRAM (2)

Flashing code : 1.4

Component:
Temperature sensor (coolant)
(top picture, arrow)

Test 1: Resistance

Detach connector at temperature sensor.

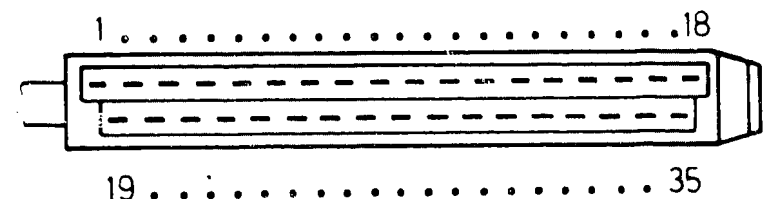
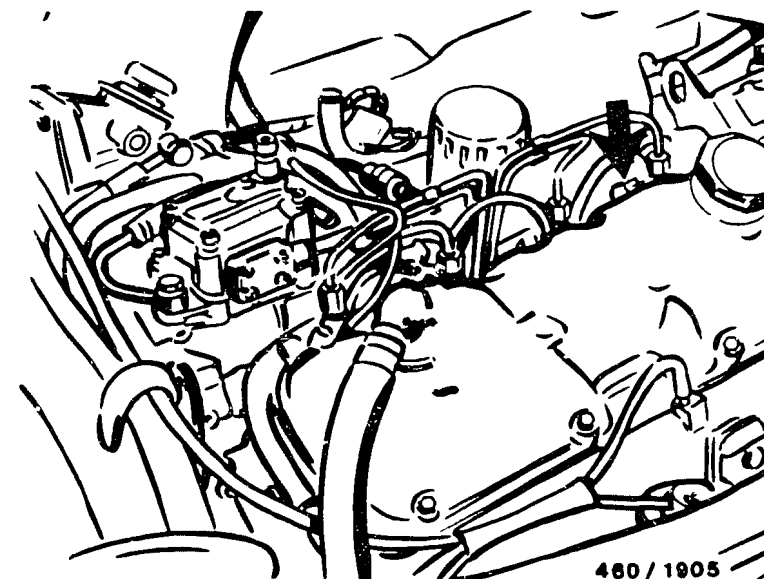
Connect multimeter with test leads KDUM 0008 to both wiring posts of temperature sensor.

Set value:
at
15...30° C = 1.3...3.6 k Ω
approx. 80° C = 250...390 Ω

Set value attained?

N>

Temperature sensor (coolant)
defective, renew.



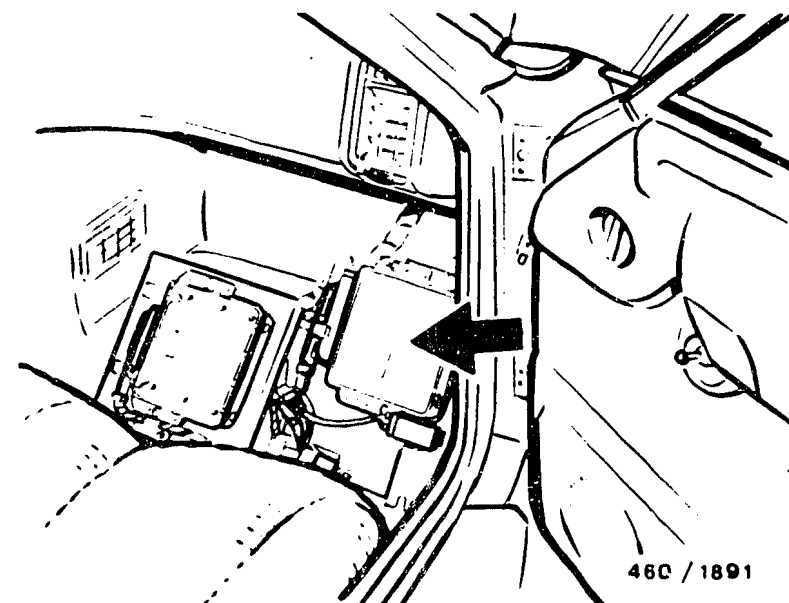
Switch off ignition.

Disconnect control-unit plug 1 and test leads from term. 23 and term. 35 to temperature sensor with test leads KDZS 0004 for open circuits and/or contact resistance.

Bridge leads at cable connector (temperature sensor).

Set value : approx. 0 Ω

If set value is obtained, replace control unit 1 (lower illustration arrow).



Test 2: Measuring-circuit voltage
Control unit

Connect multimeter with test leads KDZS 0004 to temperature-sensor connector.

Switch on ignition.

Set value: approx. 5 V

Set value attained?

N>

Return to self-diagnosis
test table B15

SELF-DIAGNOSIS TEST PROGRAM (3)

Flashing code : 1.5

Component:
Temperature sensor (fuel)
(Top picture, arrow)

Test 1: short-circuit to ground

Detach connector (center picture, arrow) at fuel-injection pump.

Attach test adapter KDEP 1165 with adapter lead KDEP 1165/200 (bottom picture) to fuel-injection pump.
Connect multimeter with commercially available test leads to test sockets listed below.

5 and ground
6 and ground

Set value: > 1 M Ω

Set value attained?

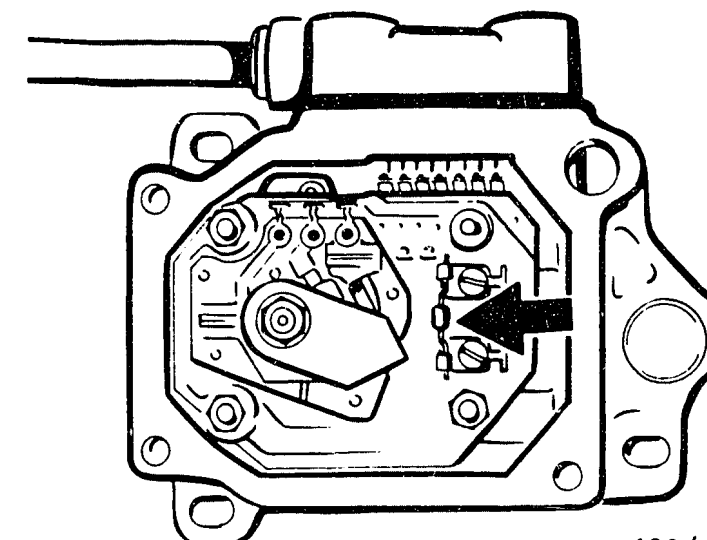
N>

Remove closing cover from injected-quantity adjuster.

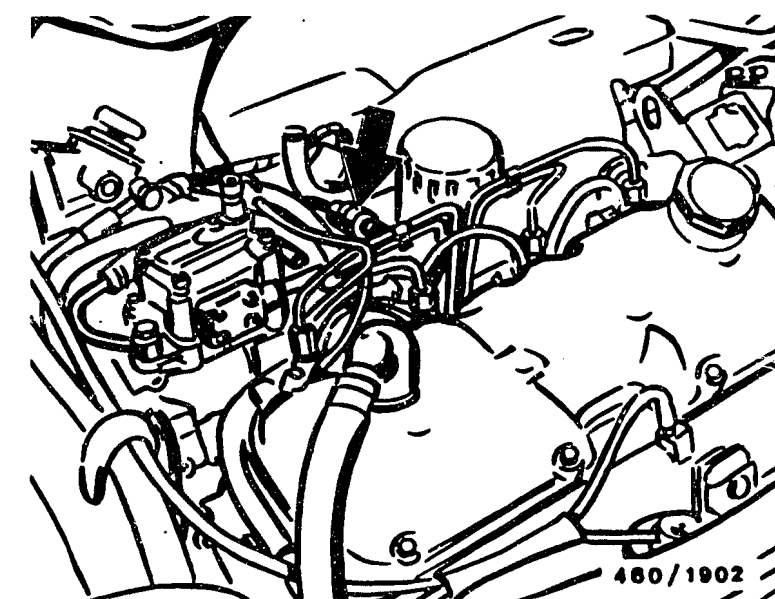
Test wiring post and conductors of potentiometer for short-circuit to ground.

If applicable, renew temperature sensor and/or injected-quantity adjuster.
(Potentiometer cannot be individually replaced).

N o t e :
Pay attention to cleanliness and use new seal.



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Test 2: Short-circuit

Connect multimeter with commercially available test leads to test sockets 4 and 6.
Set value: > 1 M Ω

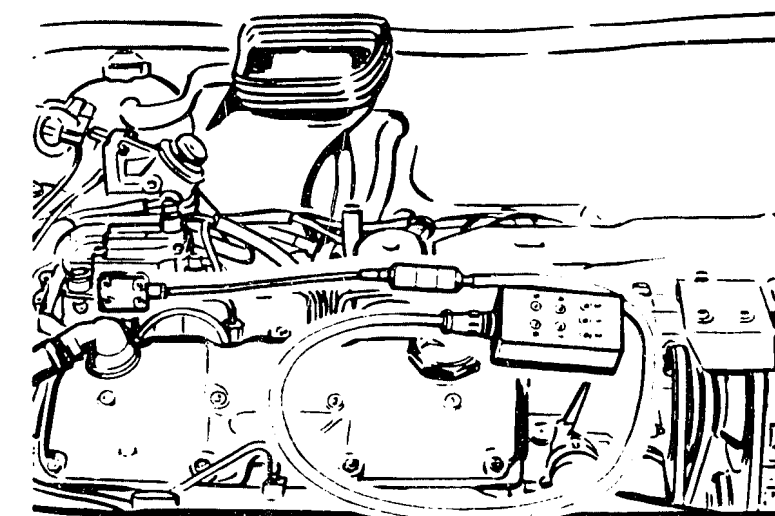
Set value attained?

N>

Remove closing cover from injected-quantity adjuster.

Test wiring post and conductors for contact/contacting caused by foreign bodies.

Eliminate fault, if applicable
renew temperature sensor and/or
injected-quantity adjuster.



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Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (3) (CONTINUED 1)

Test 3 : Internal resistance

Connect multimeter with commercially available test leads to test sockets 5 and 6 (top picture).

Set value: see brief instructions

Set value attained?

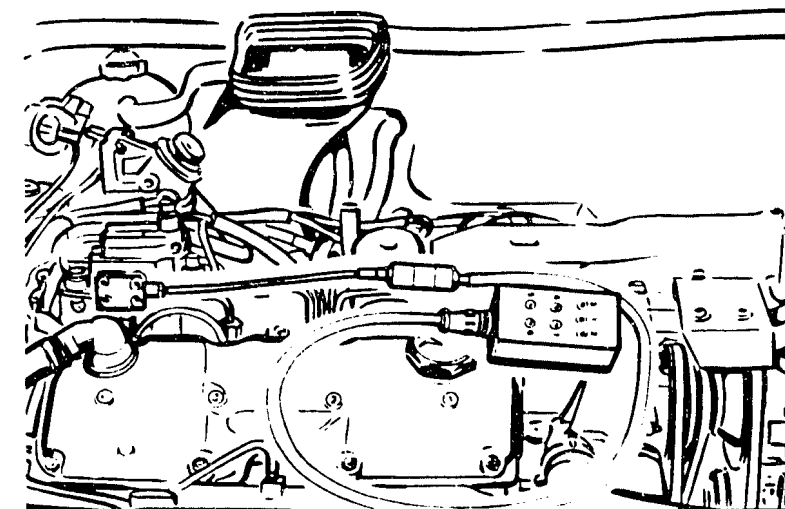
N>

Temperature sensor defective, replace.

Remove closing cover from delivery controller, loosen clamping screws, replace temperature sensor.

N o t e:

Make sure everything is clean and use new gasket.



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Test 4 : Measuring-circuit voltage - control unit

Attach test adapter KDEP 1165 with adapter lead KDEP 1165/201 to connecting lead for control unit.

Connect multimeter with commercially available test leads to test sockets 5 and 6.

Switch on ignition.

Set value: approx. 5 V

Set value attained?

N>

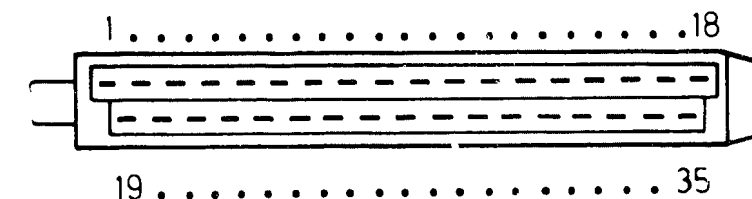
Switch off ignition.

Disconnect control-unit plug (center illustration) and test leads term. 24 and term. 35 to test adapter with test leads KDZS 0004 for open circuit and/or contact resistance.

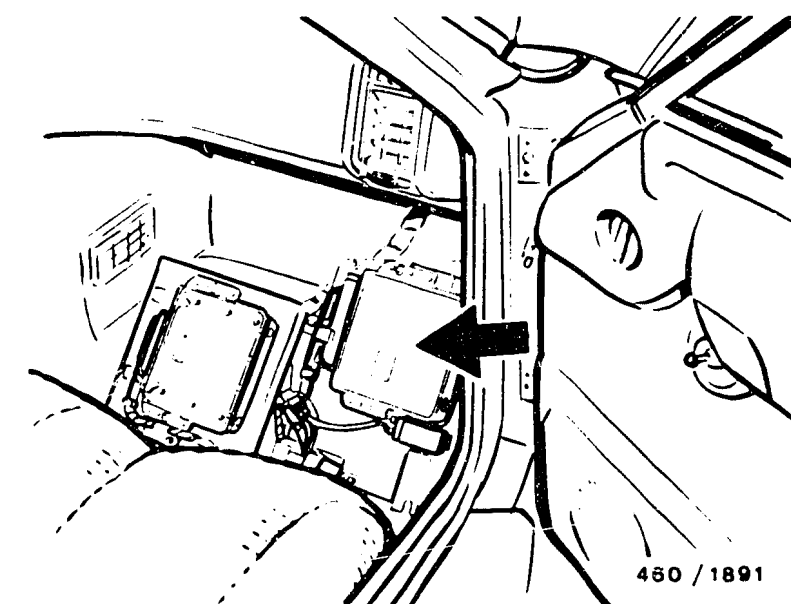
Bridge measuring sockets 5 and 6.

Set value: approx. 0 Ω

If set value is obtained, replace control unit 1 (lower illustration, arrow).



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Return to self-diagnosis test table B15

SELF-DIAGNOSIS TEST PROGRAM (4)

Flashing code : 2.1

Component: Accelerator-pedal sensor
(top picture, arrow)

N>

If value is outside tolerance
or at infinity Ω , replace
accelerator pedal.

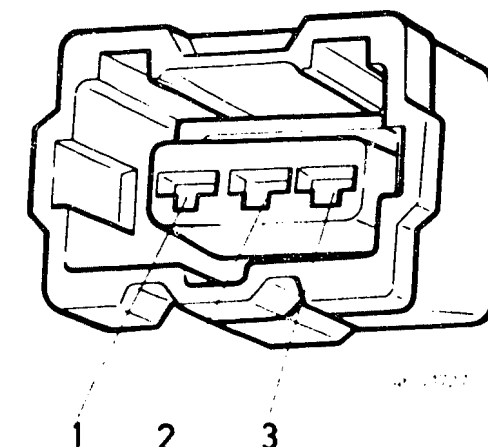
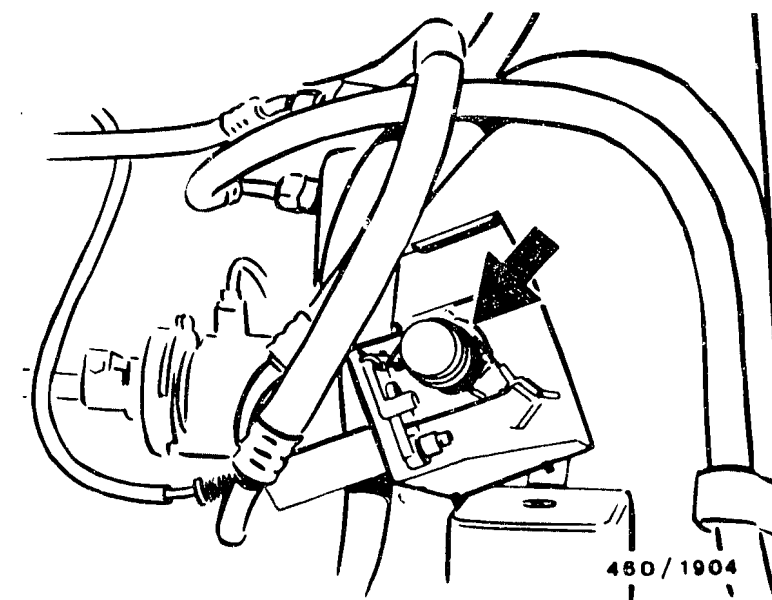
Test 1 : Internal resistance

Detach connector at accelerator-
pedal sensor.

Connect multimeter with test leads
KDUM 0008 to accelerator-pedal
sensor term. 1 and term. 3.

Set value: see brief instructions

Set value attained?



Test 2: Voltage supply

Detach connector at accelerator-
pedal sensor.

N>

Switch off ignition.

Connect multimeter with test leads
KDZS 0004 to connector term. 1 (-)
and term. 3 (+)
(center picture).

Disconnect control-unit plug
(lower illustration) and test
leads from term. 10 and term. 17
to cable connector of
accelerator pedal with test
leads KDZS 0004 for open
circuit and/or contact resistance.

Switch on ignition.

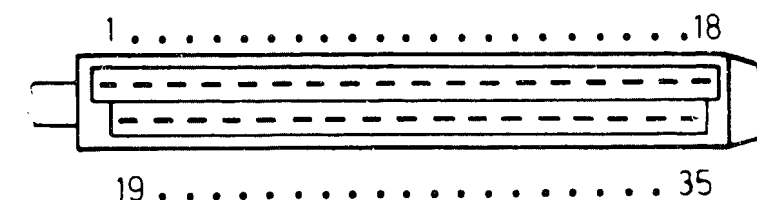
Set value: 4.5...5.5 V

Set value attained?

Bridge leads term. 1 and 3 at
cable connector of accelerator
pedal (center illustration).

Set value: approx. 0 Ω

If set value is obtained,
replace control unit 1.



Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (4) (CONTINUED 1)

Y
V

Test 3 : Voltage signal
Accelerator-pedal sensor

N>

Attach connector to accelerator-pedal sensor.
Pull back protective rubber cap at connector.
Connect multimeter with test leads KDZS 0004 to connector term. 1 and term. 2 (top picture).
Switch on ignition.
Refer to brief instructions for set values as regards idle and full-load position.
Note:
Determine voltage values by deflecting accelerator-pedal sensor.
Set values attained?

Accelerator pedal defective, replace.

Y
V

Test 4: Lead connecting
control unit to
component

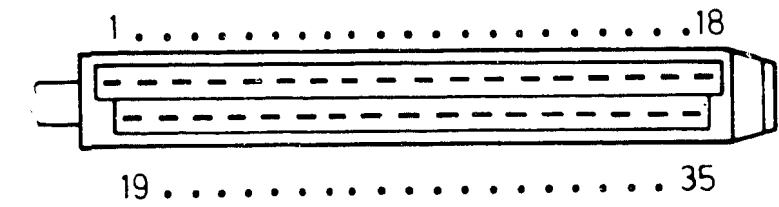
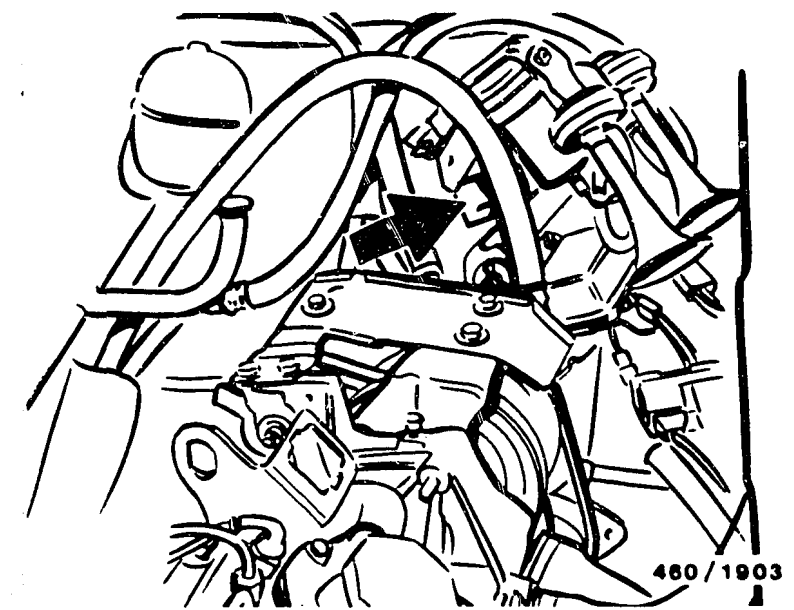
N>

Switch off ignition.
Detach control-unit plug 1 and test for open-circuits in leads term. 10 and term. 13 to connector of accelerator-pedal sensor.
Jumper leads term. 1 and term. 2 at connector (accelerator-pedal sensor, top picture).
Set value: approx. 0 Ω
Set value attained?

Eliminate open-circuit in lead (lead term. 13).

Y
V

Return to self-diagnosis
test table B15



SELF-DIAGNOSIS TEST PROGRAM (5)

Flashing code: 2.2

Component:
Control-collar travel sensor
(top picture, arrow)

Test 1: Short-circuit to ground

Detach connector (2, center picture) at fuel-injection pump. Attach test adapter KDEP 1165 with adapter lead KDEP 1165/200 to connecting lead for fuel-injection pump (bottom picture). Connect multimeter with commercially available test leads to test sockets listed below:

- 1 and ground
- 2 and ground
- 3 and ground

Set value: > 1 M Ω

Set value attained?

N>

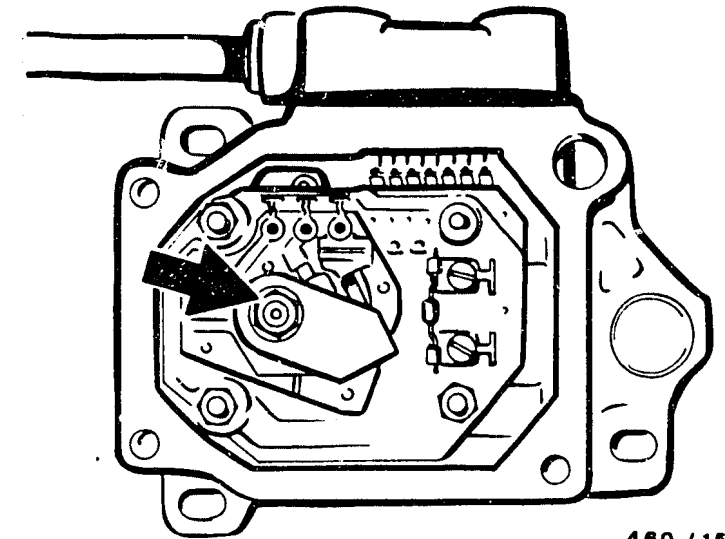
Remove closing cover from injected-quantity adjuster.

Test wiring posts and conductors for short-circuit to ground.

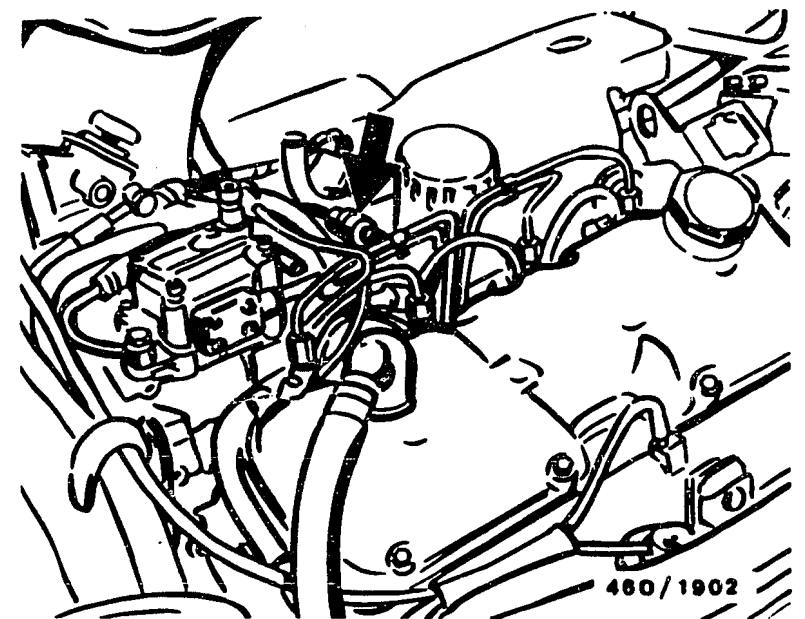
If applicable, remove fuel-injection pump and renew injected-quantity adjuster.

Note:

The potentiometer cannot be changed as an individual item.



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Test 2: Short-circuit

Connect multimeter with commercially available test leads to test sockets 2 and 7.

Set value: > 1 M Ω

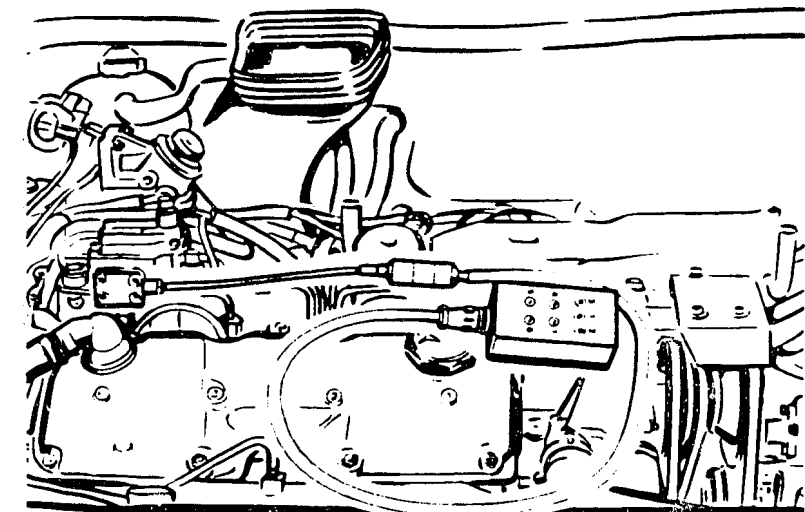
Set value attained?

N>

Remove closing cover from injected-quantity adjuster.

Test wiring post and conductors for contact/contacting caused by foreign bodies.

Eliminate fault, if applicable remove fuel-injection pump and renew injected-quantity adjuster.



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Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (5) (CONTINUED 1)

Test 3: Resistance of potentiometer track
(top picture)

Connect multimeter with commercially available test leads to test sockets 2 and 3.

Set value: see brief instructions

Set value attained?

N>

Angle potentiometer defective,
remove fuel-injection pump.
Renew injected-quantity adjuster.

Test 4 : Resistance
Wiper track
(Top picture)

Connect multimeter with commercially available test leads to test sockets 1 and 3.

Set value: see brief instructions

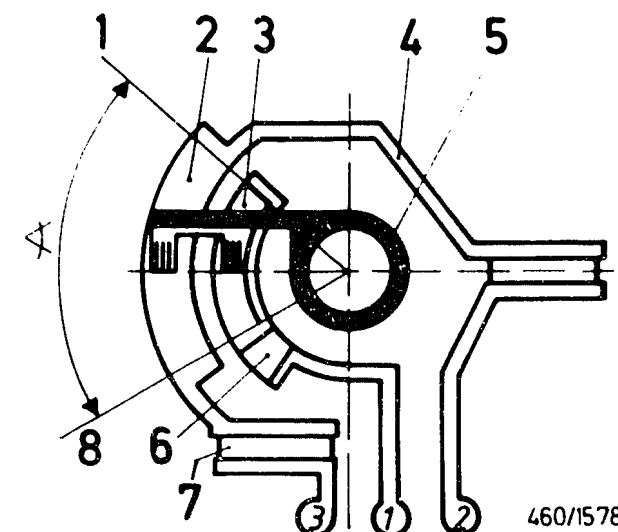
Set value attained?

N>

Resistors, potentiometer path/
wiper path or wiper defective.

Remove fuel-injection pump.
Replace delivery controller.

Continued on next picture page



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- 1 = Excess-fuel stop
- 2 = Potentiometer track
- 3 = Wiper track
- 4 = Conductor
- 5 = Wiper
- 6 = Series resistor
- 7 = Trimmer resistors
- 8 = Shutoff stop

SELF-DIAGNOSIS TEST PROGRAM (5) (CONTINUED 2)

Test 5 : Voltage supply

Attach test adapter KDEP 1165 with adapter lead KDEP 1165/201 to connecting lead for control unit.

Connect multimeter with commercially available test leads to test sockets 2 (+) and 3 (-) (bottom picture).

Switch on ignition.

Set value: 4.5...5.5 V

Set value attained?

N>

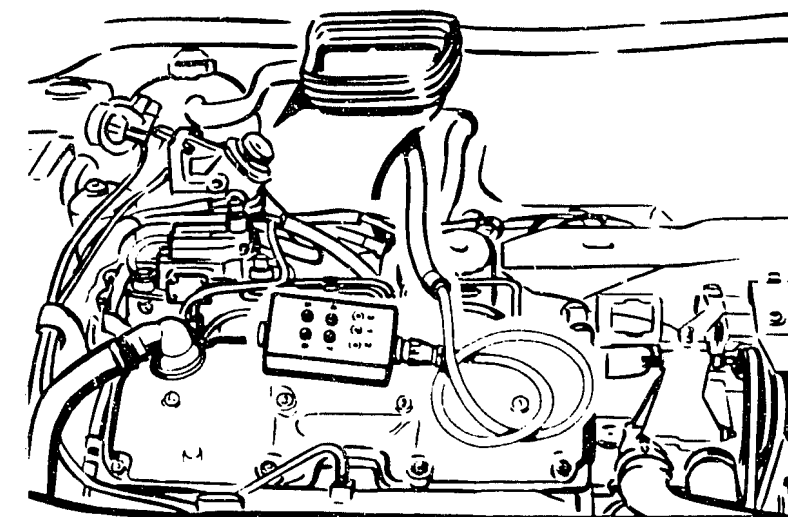
Switch off ignition.

Disconnect control-unit plug 1 and test leads from term. 10 and term. 29 to test adapter with test leads KDZS 0004 for open circuit and/or contact resistance.

Bridge measuring sockets 2 and 3 (upper illustration).

Set value: approx. 0 Ω

If set value is obtained, replace control unit 1.



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Test 6 : Voltage signal - potentiometer

Connect both adapter leads to test adapter KDEP 1165. Connect multimeter with commercially available test leads to test sockets 1 and 3. Switch on ignition.

Detach connector at temperature sensor (coolant) and needle-motion sensor.

Set value: see brief instructions

Attach connector to needle-motion sensor.

Set value: see brief instructions

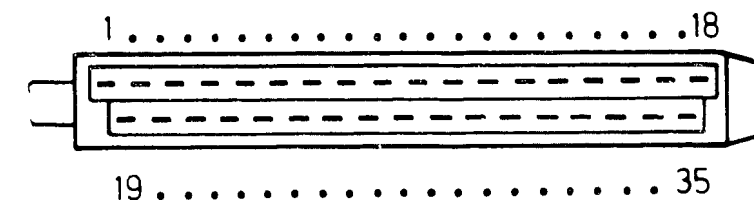
Set values attained?

N>

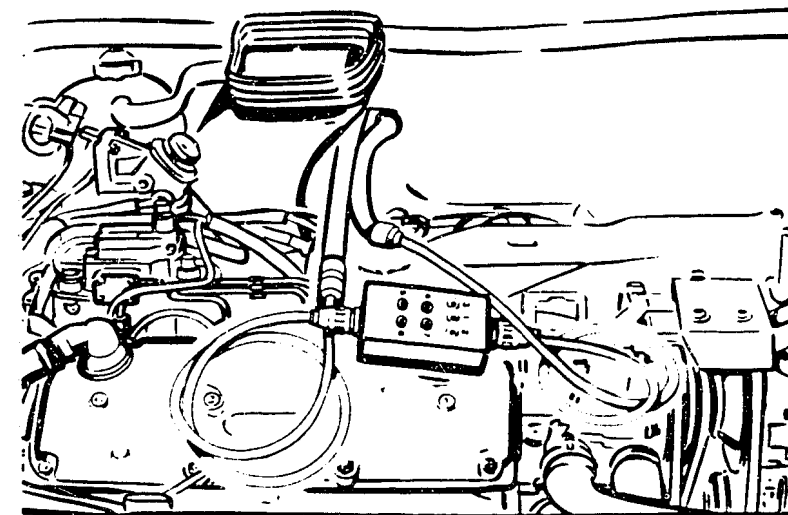
Remove closing cover from delivery controller.

Check whether potentiometer reaches shutoff and starting positions when delivery controller is deflected.

If potentiometer is deflected, remove fuel-injection pump and replace delivery controller.



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Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (5) (CONTINUED 3)

Test 7 : Lead connecting control unit and component

N>

Eliminate open-circuit in lead or contact resistance.

Switch on ignition.

Attach test adapter KDEP 1165 with adapter lead KDEP 1165/201 to connecting lead for control unit.

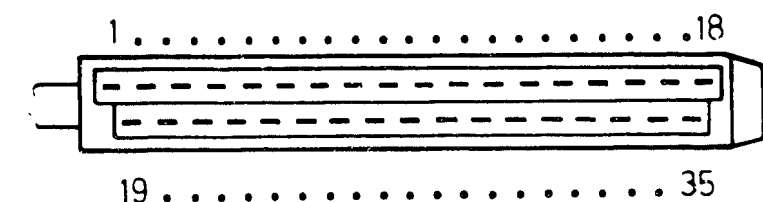
Jumper test sockets 1 and 3 at test adapter.

Detach control-unit plug 1 (bottom picture) and test for open-circuit/contact resistance in leads from term. 6 and term. 10 (top picture) to test adapter using test leads KDZS 0004.

Set value approx. 0 Ω

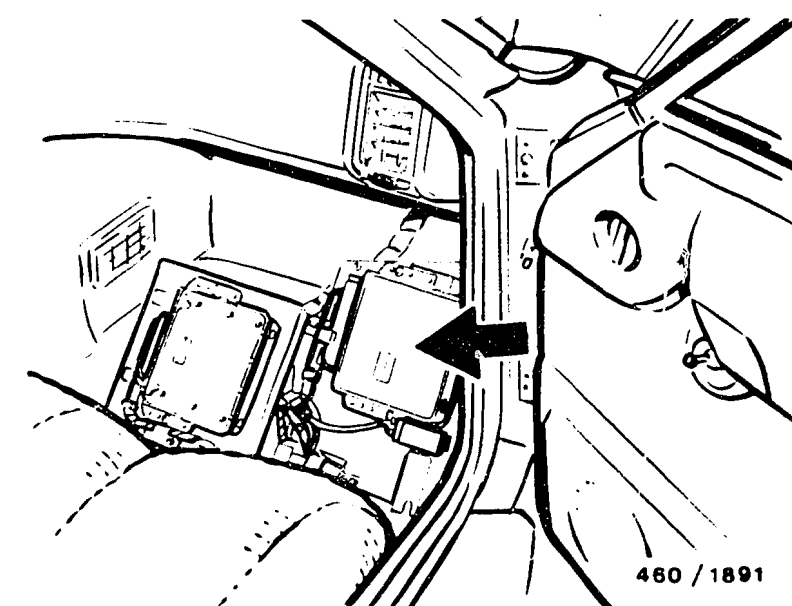
Set value attained?

Return to self-diagnosis test table B17



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Arrow = Delivery and road-speed control unit
(Designated control unit 1 in the trouble-shooting instructions)
Installation position: Passenger-side footrest



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SELF-DIAGNOSIS TEST PROGRAM (6)

Flashing code: 2.3

Component:
Injected-quantity adjuster
(top picture, arrow)

Test 1: Short-circuit to ground

Detach connector at fuel-injection
pump.

Attach test adapter KDEP 1165 with
adapter lead KDEP 1165/200 to
connecting lead for fuel-injection
pump (center picture).

Connect multimeter with
commercially available test leads
to test sockets listed below
(center picture).

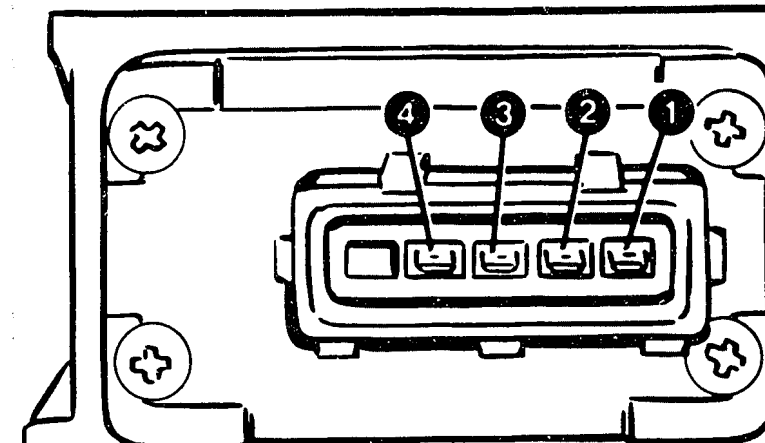
4 and ground
7 and ground

Set value: > 1 M Ω

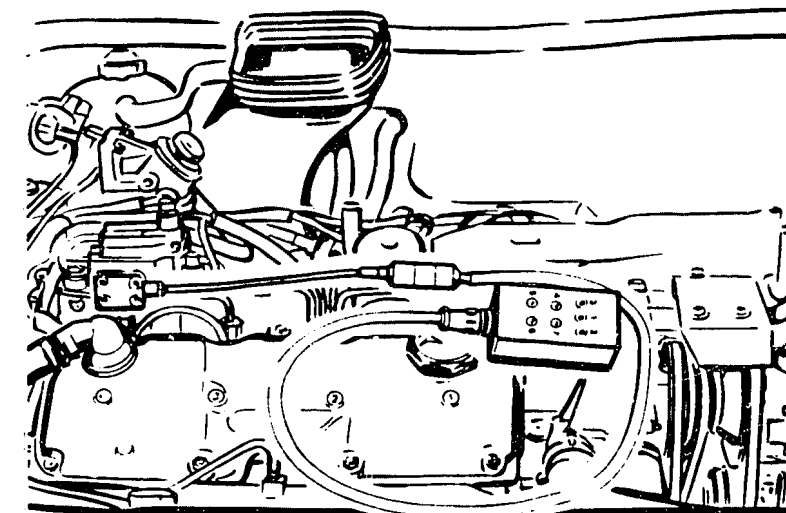
Set value attained?

N>

If test specification is not
obtained, remove fuel-injection
pump and replace delivery
controller.



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Test 2: Internal resistance

Connect multimeter with
commercially available test leads
to test sockets 4 and 7.

Set value: see brief instructions

Set value attained?

N>

If test specification is not
obtained, remove fuel-injection
pump and replace delivery
controller.

Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (6) (CONTINUED 1)

Test 3 :

Lead connecting control unit and component

N>

Eliminate open circuit in lead and/or contact resistance.

Attach test adapter KDEP 1165 with adapter lead KDEP 1165/201 to connecting lead for control unit. Jumper test sockets 4 and 7 at test adapter. Detach control-unit plug 1 (top picture) and test for open-circuit/contact resistance in leads from term. 1 and term. 21 (center picture) to test adapter using test leads KDZS 0004.

Set value: approx. 0 Ω

Set value attained?

Y

V

Test 4 : Voltage supply

N>

Control unit 1 (top picture, arrow) defective, renew.

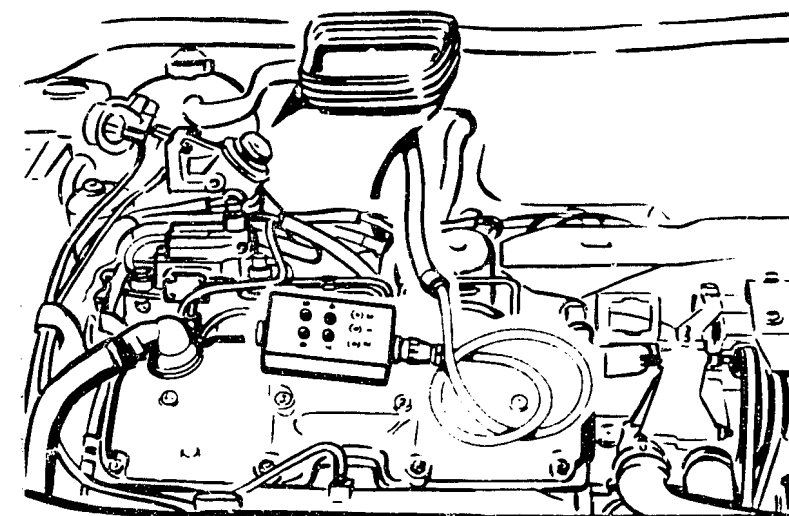
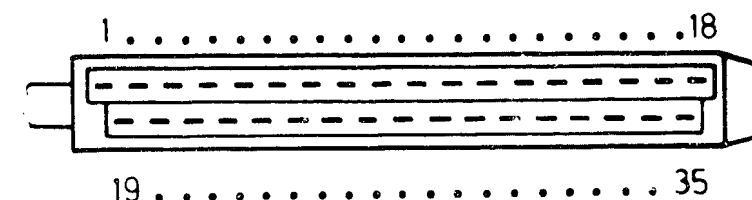
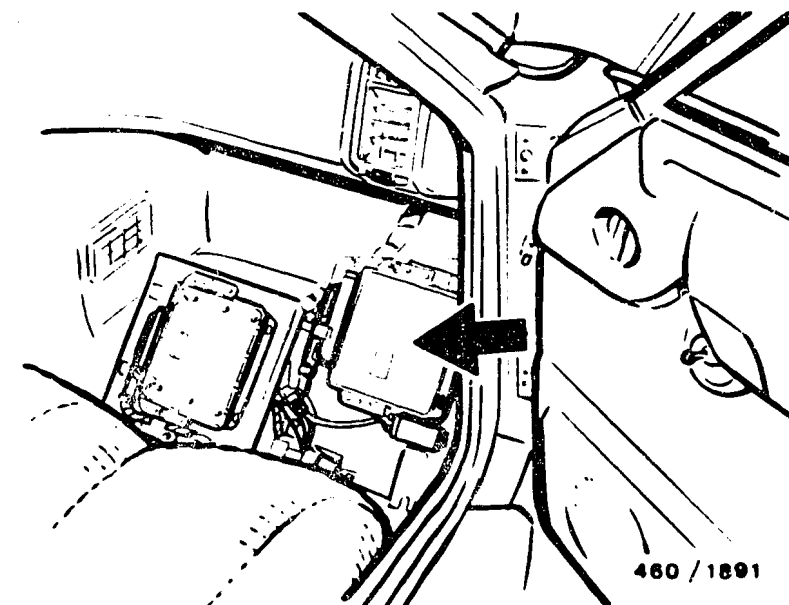
Attach test adapter KDEP 1165 with adapter lead KDEP 1165/201 to connecting lead for control unit. Connect multimeter with commercially available test leads to test sockets 3 (-) and 7 (+) (bottom picture). Connect control unit. Switch on ignition.

Set value: 8.5...14.5 V

Set value attained?

V

Return to self-diagnosis test table B19



SELF-DIAGNOSIS TEST PROGRAM (7)

Flashing code : 3.1

Component:
Atmospheric pressure sensor
(top picture, arrow)

Test 1 : Voltage supply

Detach connector at atmospheric
pressure sensor.

Connect multimeter with test
leads KDZS 0004 to connector
term. 1 (-) and term. 3 (+)
(top picture).

Switch on ignition.

Set value: 4.5...5.5 V

Set value attained?

N>

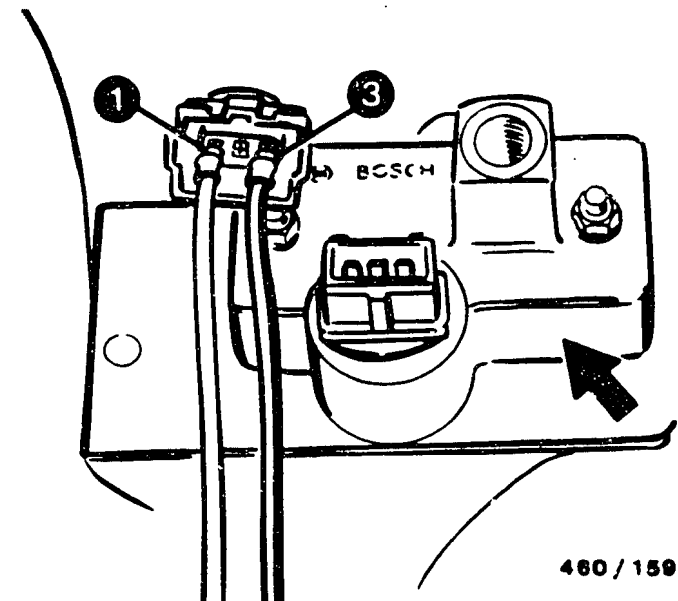
Switch off ignition.

Disconnect control-unit plug 1
and test leads from term. 28
and term. 35 (center illus-
tration) to atmospheric-pressure
sensor for open circuit and/or
contact resistance.

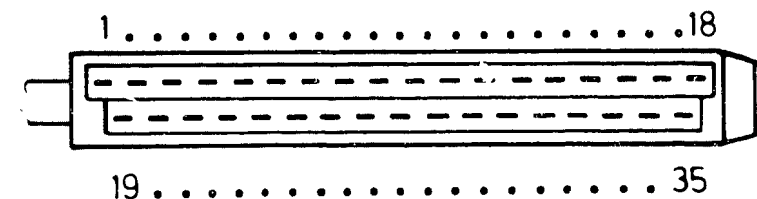
Bridge leads at cable connector
of atmospheric-pressure sensor.

Set value: approx. 0 Ω

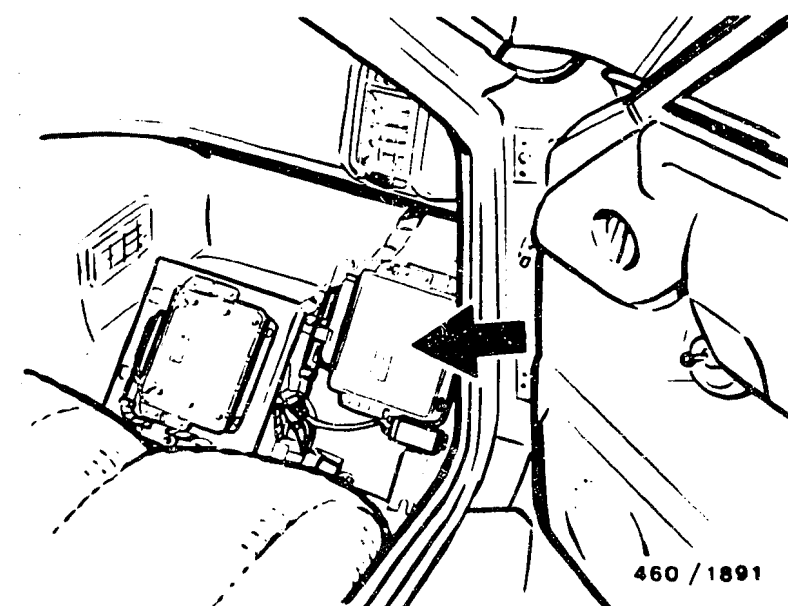
If set value is obtained,
replace control unit 1 (lower
illustration, arrow).



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460/1573



460/1891

Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (7) (CONTINUED 1)

Test 2 : Voltage signal
Atmospheric pressure
sensor

N>

Atmospheric-pressure sensor
defective, replace.

Attach connector to atmospheric
pressure sensor.
Pull back rubber cap at connector.
Attach multimeter with test leads
KDZS 0004 to connector term. 1 and
term. 2.
Determine atmospheric pressure
(barometer reading).
Switch on ignition.

Set value: see characteristic curve
(center picture)

Set value attained?

Y

V

Test 3: Cable connection,
control unit -
component

N>

Eliminate open circuit in
lead.

Switch off ignition.
Disconnect control-unit plug 1
and test leads from term. 28
and term. 34 (lower illustration)
to cable connector of
atmospheric-pressure sensor for
open circuit.
Bridge leads term. 1 and term. 2
at cable connector of
atmospheric-pressure sensor.

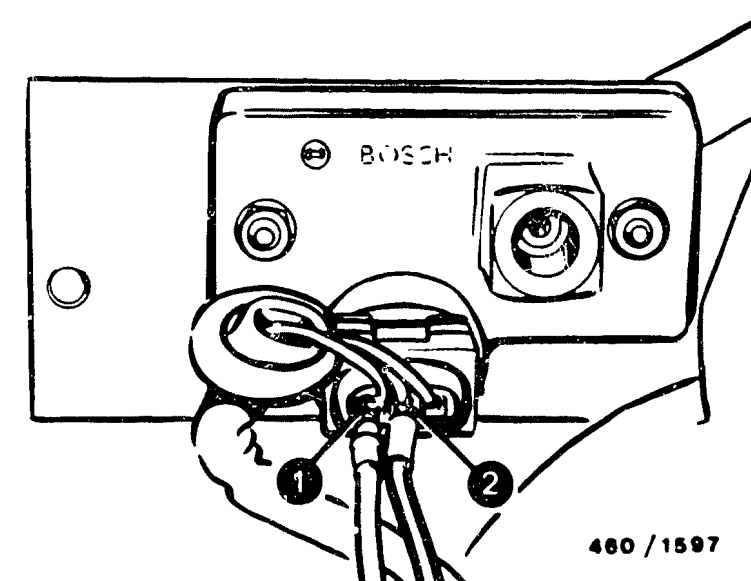
Set value: approx. 0 Ω

Is set value obtained?

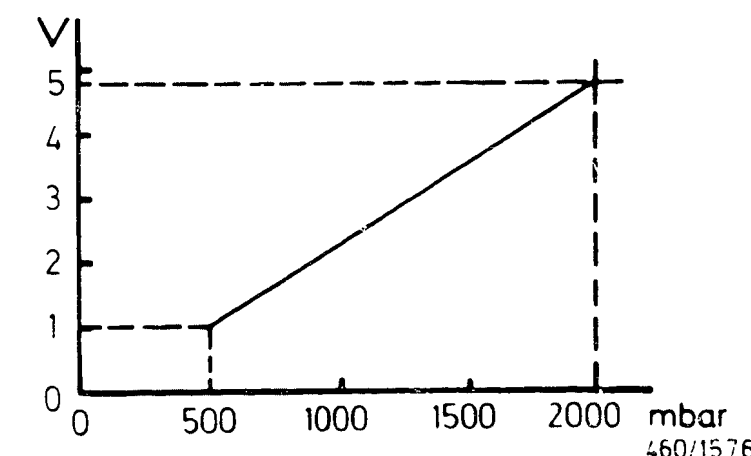
Y

V

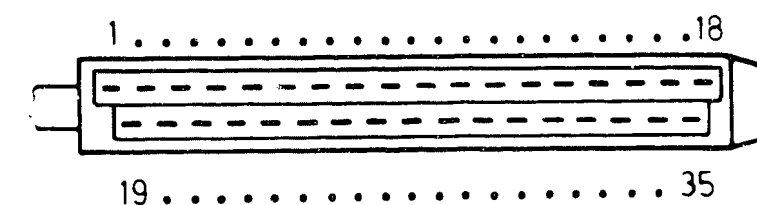
Return to self-diagnosis
test table B21



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460 / 1573

SELF-DIAGNOSIS TEST PROGRAM (8)

Flashing code : 3.3

Component:
Air-flow sensor
(top picture, arrow)

Test 1 : Overall resistance

Detach connector at air-flow
sensor.

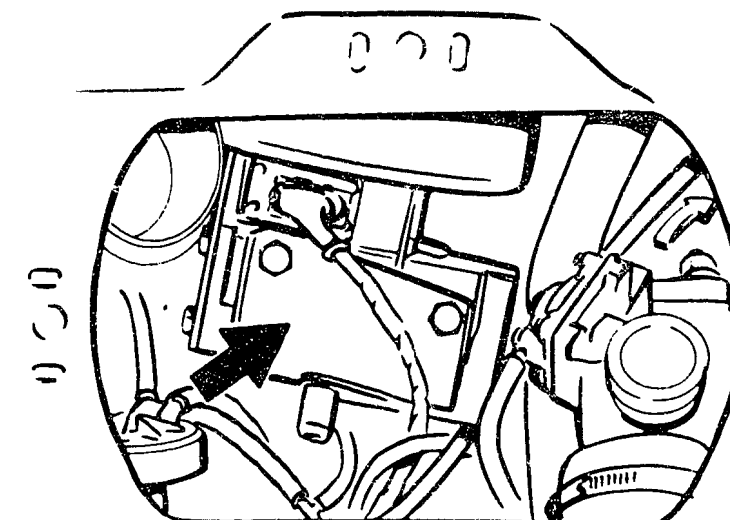
Connect multimeter with test leads
KDUM 0008 to air-flow sensor
term. 3 and term. 4 (see picture).

Set value: see brief instructions

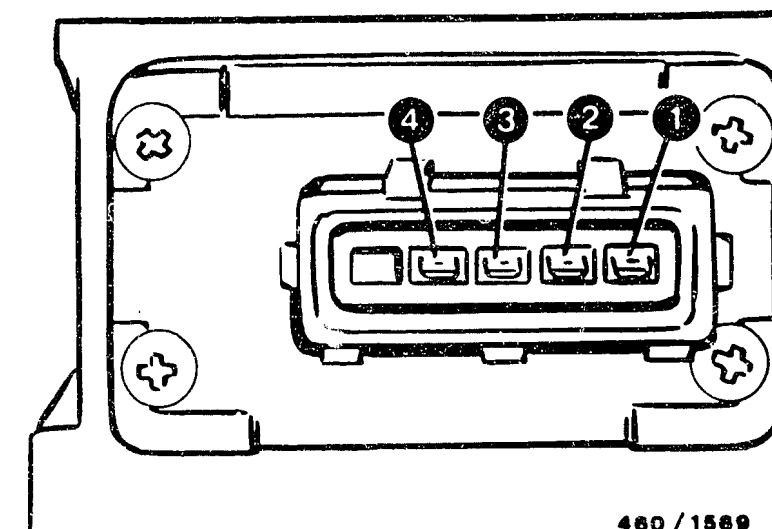
Set value attained?

N>

Air-flow sensor defective,
replace.



460 / 1598



460 / 1569

Continued on next picture page

D01

<=>

D02

<=>

SELF-DIAGNOSIS TEST PROGRAM (8) (CONTINUED 1)

Test 2 : Voltage supply

Connect multimeter with test leads KDZS 0004 to connector term. 3 (+) and 4 (-) (top picture).
Switch on ignition.

Set value: 4.5...5.5 V

Set value attained?

N>

Switch off ignition.

Disconnect control-unit plug 2 (lower illustration) and test leads from term. 4 and term. 24 (center illustration) to cable connector of air-flow sensor for open circuit and/or contact resistance.

Bridge leads term. 3 and term. 4 at cable connector of air-flow sensor.

Set value: approx. 0 Ω

If set value is obtained, replace control unit 2.

Test 3: Voltage signal Air-flow sensor

Connect connector to air-flow sensor.

Pull back rubber cap at connector.

Connect multimeter with test leads KDZS 0004 to term. 2 and term. 4.

Switch on ignition.

Set value: see brief instructions

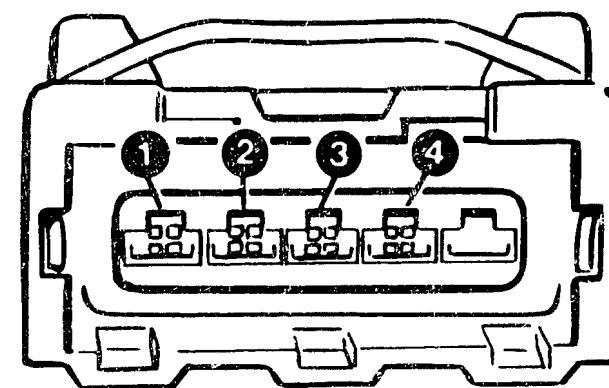
Deflect sensor flap.

Set value: see brief instructions

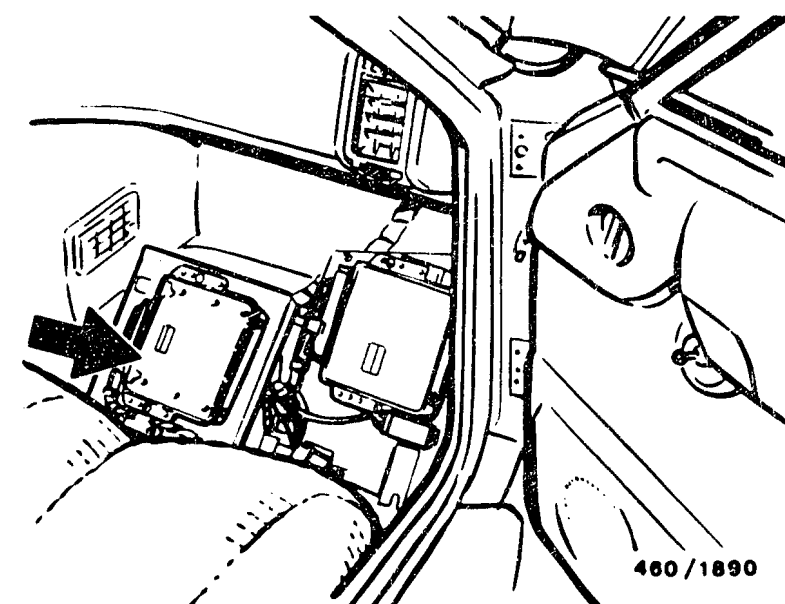
Set value attained?

N>

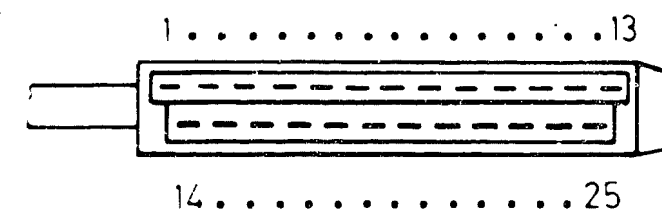
Air-flow sensor defective, replace.



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460/1890



460/1878

Continued on next picture page

D03

<=>

D04

<=>

SELF-DIAGNOSIS TEST PROGRAM (8) (CONTINUED 2)

Test 4:
Cable connection, control unit
to component:

N>

Eliminate open circuit in
lead term. 10.

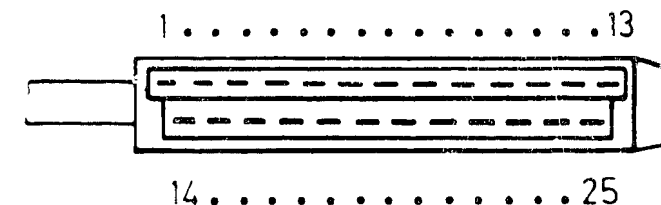
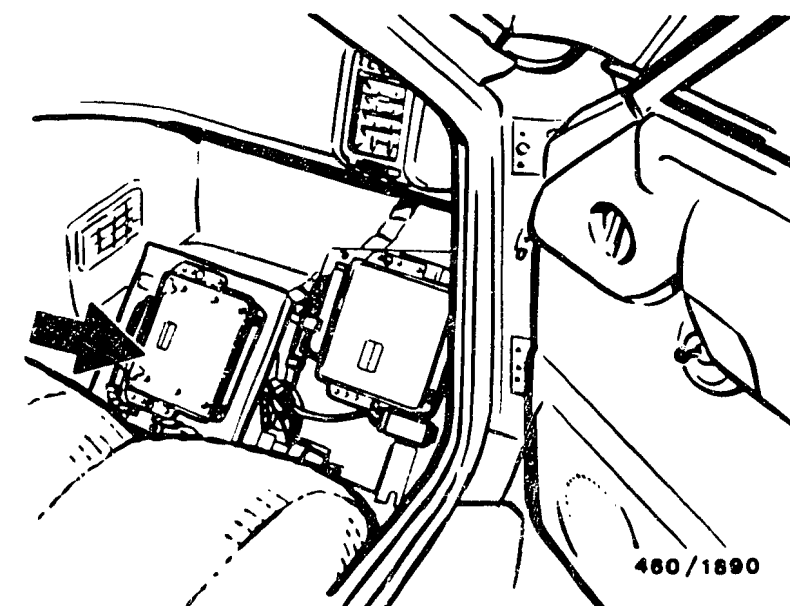
Switch off ignition.

Disconnect control-unit plug 2
and test leads from term. 4
and term. 10 (upper illus-
tration) to cable connector
of air-flow sensor for open
circuit.

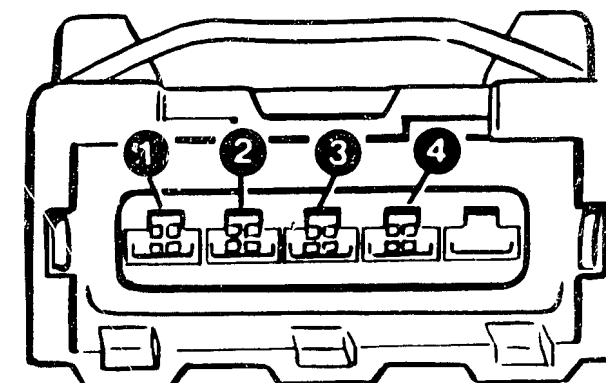
Bridge leads term. 2 and
term. 4 at cable connector
of air-flow sensor.

Set value: approx. 0 Ω

Is set value obtained?



460.1575



460/1600

Continued on next picture page

Test 5:
Potentiometer test
(Noise test)

N>

Air-flow sensor defective,
replace.

For testing, use Motortester.

Press special input and
10 ms buttons.

Pull back rubber cap on cable
connector of air-flow
sensor.

Connect Motortester with test
leads KDZS 0004 to cable
connector term. 2 and term. 4
(upper illustration).

Switch on ignition.

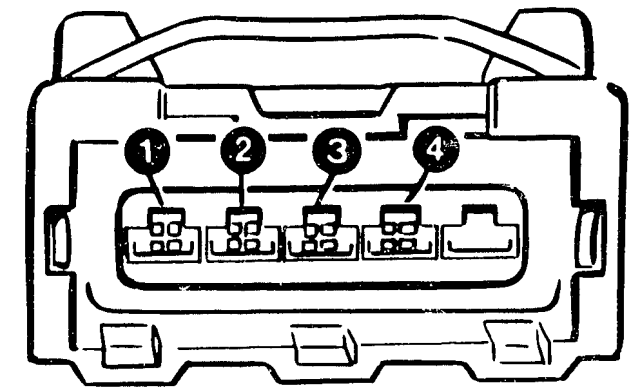
Deflect sensor flap of air-flow
sensor violently several
times (center illustration).

If the air-flow sensor is in
good condition, a stroke signal
without interruptions must be
visible on the oscilloscope.

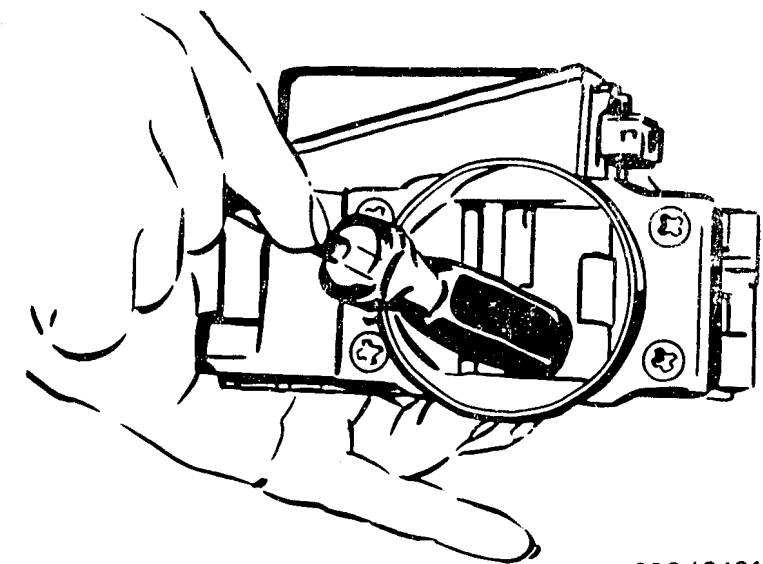
If the air-flow sensor is
defective, a noise signal
similar to that illustrated
on the right appears.

Is signal pattern O.K.?

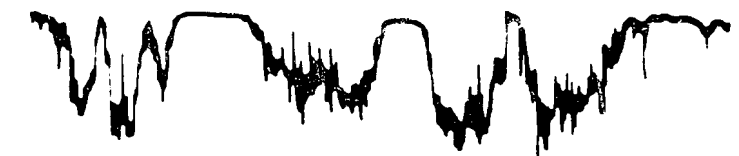
Return to self-diagnosis
test table B21



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280 / 0481



280 / 0264

SELF-DIAGNOSIS TEST PROGRAM (9)

Flashing code : 3.4

Component:
Electropneumatic pressure
transducer (EGR)
(top picture, arrow)

Test 1: Internal resistance

Detach connector at pressure
transducer.

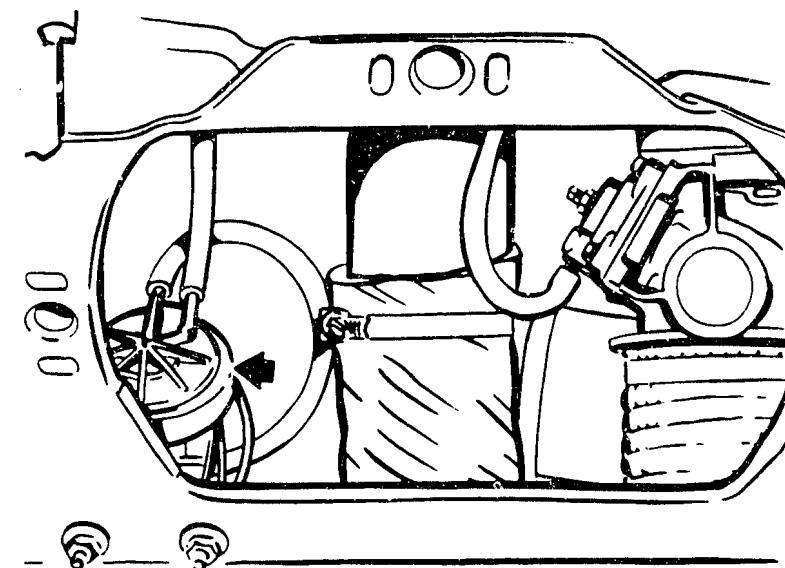
Connect multimeter with
commercially available test leads
to both wiring posts of pressure
transducer.

Set value:
at approx. 20° C = 5.0...6.0 Ω

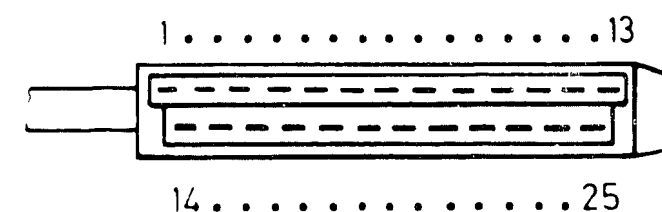
Set value attained?

N>

Pressure transducer defective,
replace.



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460-1575

Test 2: Measuring-circuit voltage
Control unit

Connect multimeter with
commercially available test leads
to both connectors.

Switch on ignition.

Set value: approx. 12 V

Set value attained?

N>

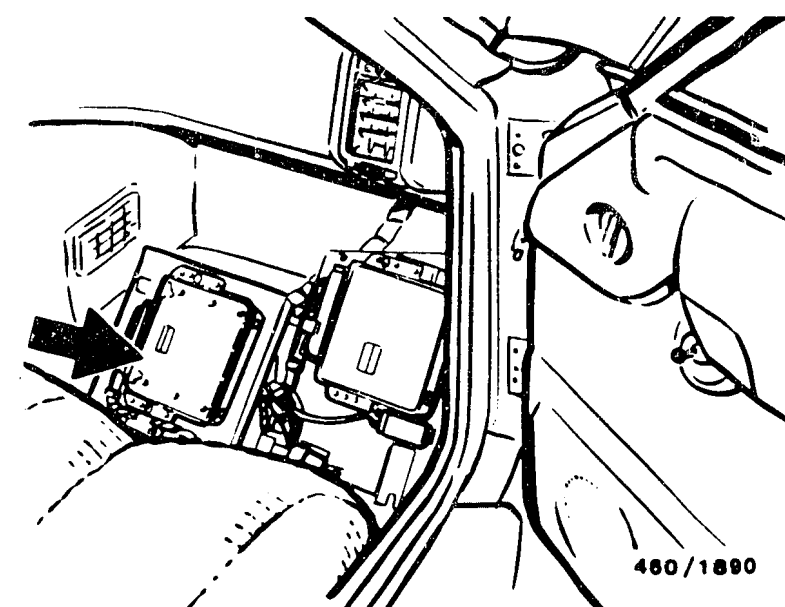
Switch off ignition.

Disconnect control-unit plug 2
(lower illustration) and test
leads from term. 1 and term. 7
(center illustration) to
pressure transducer with test
leads KDZS 0004 for open circuit
and/or contact resistance.

Bridge leads at cable connector
of pressure transducer.

Set value: approx. 0 Ω

If set value is obtained,
replace control unit 2.



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Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (9) (CONTINUED 1)

Test 3: Actuation
on/off ratio

Connect pocket tester with
commercially available test
leads to both terminal posts
of the pressure transducer
(see illustration).

Adjust measuring range for
dwell angle and run engine
at idle speed.

Set value: see brief instruc.

Coolant-water temperature
approx. $\pm 80^{\circ}$ C.

Read off the on/off ratio
from the pocket tester.

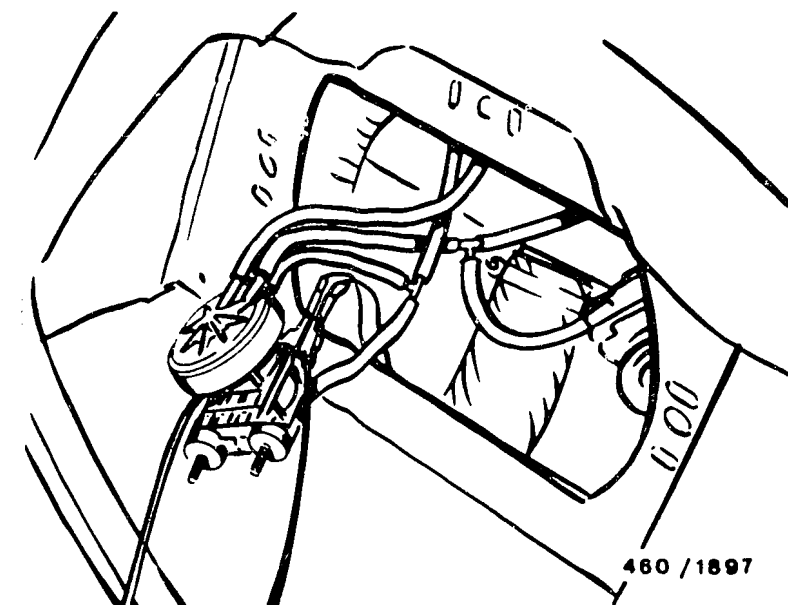
Disconnect cable connector
from coolant-temperature sensor
or air-flow sensor.

Set value: see brief instruc.

Does the on/off ratio of one
of the components change when
cable connector is disconnected?

N>

Control unit 2 defective,
replace.



Return to self-diagnosis
test table B21

SELF-DIAGNOSIS TEST PROGRAM (10)

Flashing code: 4.1

Component:
Engine-speed sensor
(top picture, arrow)

Test 1: Short-circuit to ground

Detach connector from engine-speed
sensor
(center picture, arrow).

Connect multimeter with
commercially available test leads
and test prods to one wiring post
and ground in each case.

Set value: $> 1\text{ M}\Omega$

Set value attained?

N>

Speed sensor defective,
replace.

Test 2: Internal resistance

Connect multimeter with test leads
KDUM 0008 to both wiring posts of
connector

Set value: see brief instructions

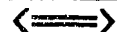
Set value attained?

N>

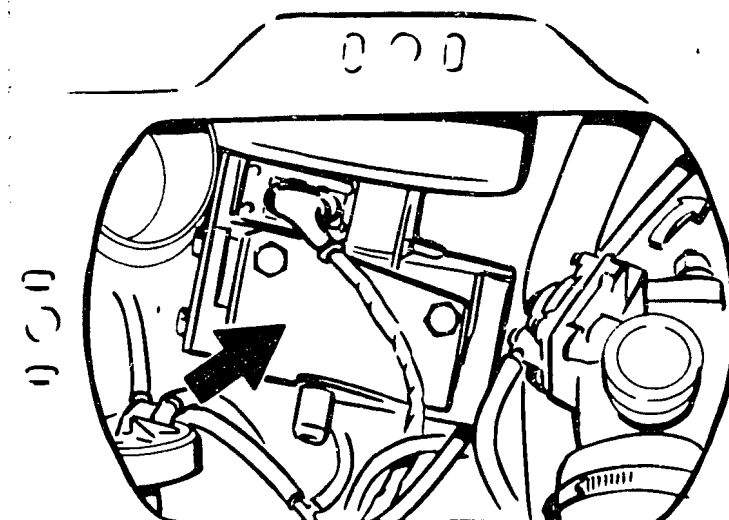
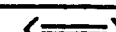
Speed sensor defective,
replace.

Continued on next picture page

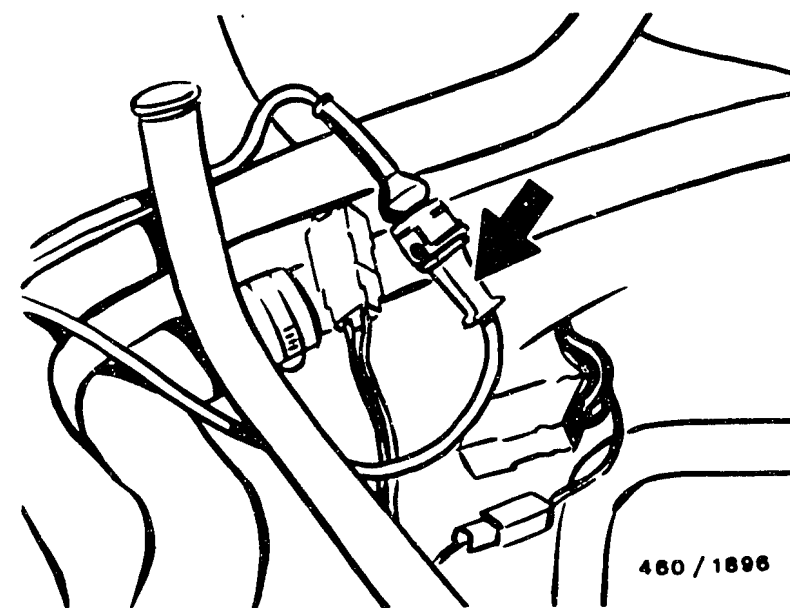
D13



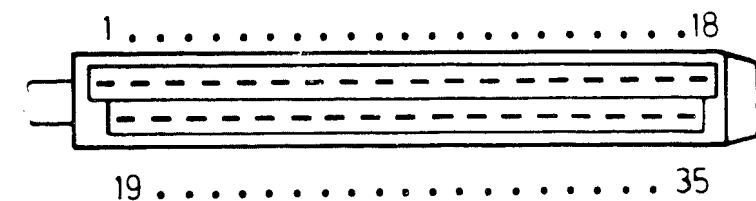
D14



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460 / 1896



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V

Test 3: Cable connection,
control unit
to component

Switch on ignition.

Disconnect control-unit plug 1
and test leads from term. 31
and term. 35 (upper illustration)
to multiple butt connector with
test leads KDZS 0004 for open
circuit and/or contact
resistance.

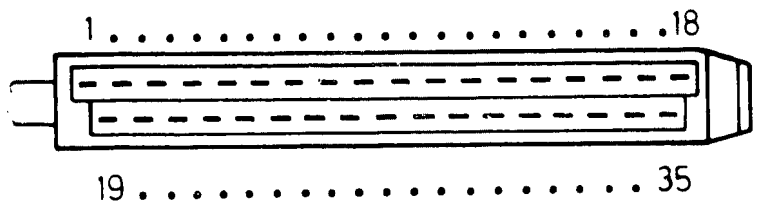
Bridge leads at multiple butt
connector.

Set value: approx. 0 Ω

Is set value obtained?

N>

Eliminate open circuit in lead
and/or contact resistance.



460/1573

V

Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (10) (CONTINUED 2)

Test 4: Signal pattern, speed sensor

For testing, use Motortester.

Press special input and %
buttons.

Set lever to left-hand stop
(calibrated voltage range).

Connect Motortester with test
leads KDZS 0004 to connected
multiple butt connector of
speed sensor.

(Plug assignment 1 = +
2 = -)

Run engine at idle speed.

For signal pattern, see
illustration alongside.

Set value: > 2 V

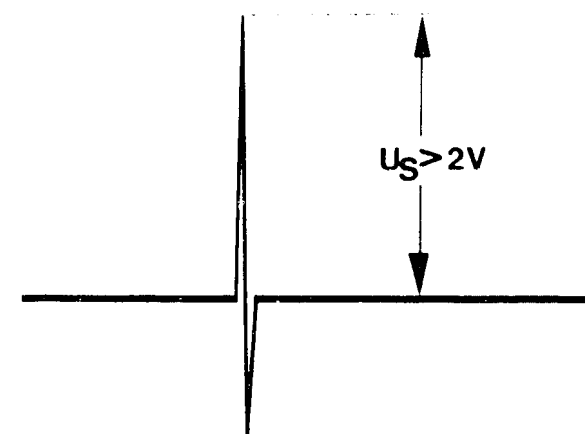
Note:
Positive signal peak must
come first.

Are signal pattern and set
value O.K.?

N>

No signal or signal too small:
speed sensor defective,
replace.

Incorrect signal:
Signal is incorrect if negative
peak comes first.
Test assignment of leads.



261/0211

Signal pattern

Return to self-diagnosis
test table B23

SELF-DIAGNOSIS TEST PROGRAM (11)

Flashing code: 4.2

Component:
Nozzle-holder assembly with
needle-motion sensor (top picture,
arrow)

Test 1: Short-circuit to ground

Detach multiple butt connector
(1, picture) from needle-motion
sensor.

Connect multimeter with test leads
KDUM 0008 to one wiring post and
ground in each case.

Set value: > 1 M Ω

Set value attained?

N>

Needle-movement sensor defective,
replace nozzle-holder assembly
as a complete unit.

Test 2: Internal resistance

Connect multimeter with test leads
KDUM 0008 to both wiring posts of
multiple butt connector.

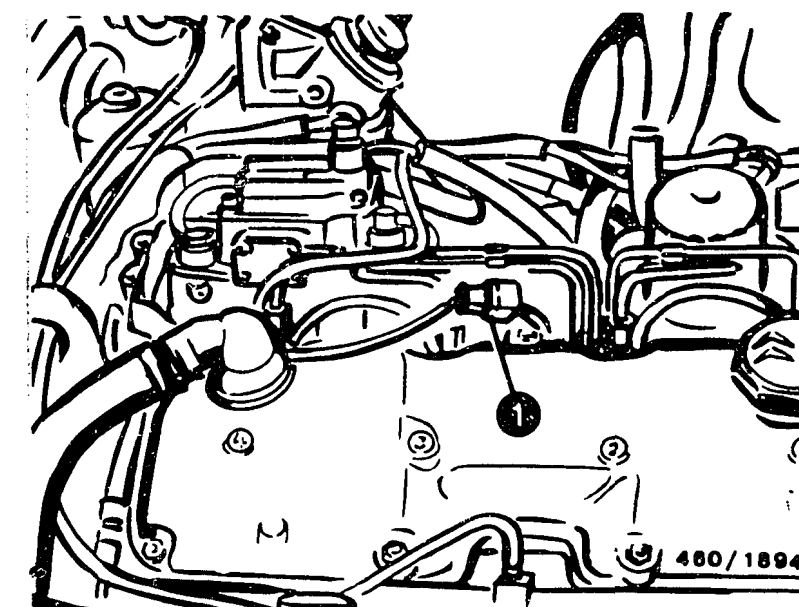
Set value: see brief instructions

Set value attained?

N>

Needle-movement sensor defective,
replace nozzle-holder assembly
as a complete unit.

Continued on next picture page



1 = Multiple butt connector,
needle-movement sen.

SELF-DIAGNOSIS TEST PROGRAM (11) (CONTINUED 1)

Test 3: Voltage supply

Connect multimeter with test leads KDZS 0004 to detached connector (1, bottom picture).

Switch on ignition.

Set value: see brief instructions

Set value attained?

N>

Switch off ignition.

Disconnect control-unit plug 2 (center illustration) and test leads from term. 3 and term. 20 (upper illustration) to multiple butt connector of needle-movement sensor with test leads KDZS 0004 for open circuit and/or contact resistance.

Bridge leads at cable connector (needle-movement sensor).

Set value: approx. 0Ω

If set value is obtained, replace control unit 2.

Test 4: Voltage signal

Connect multiple butt connector.

Pull back rubber cap at connector.

Connect multimeter with test leads KDZS 0004 to connector.

Switch on ignition.

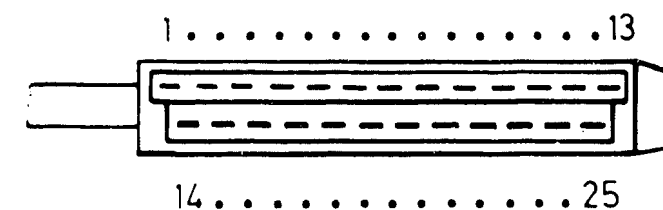
Set value: see brief instructions

Set value attained?

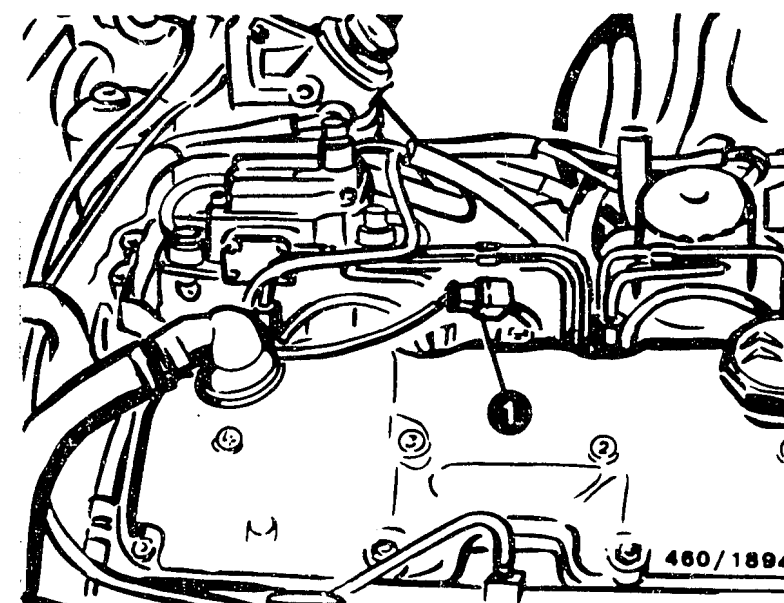
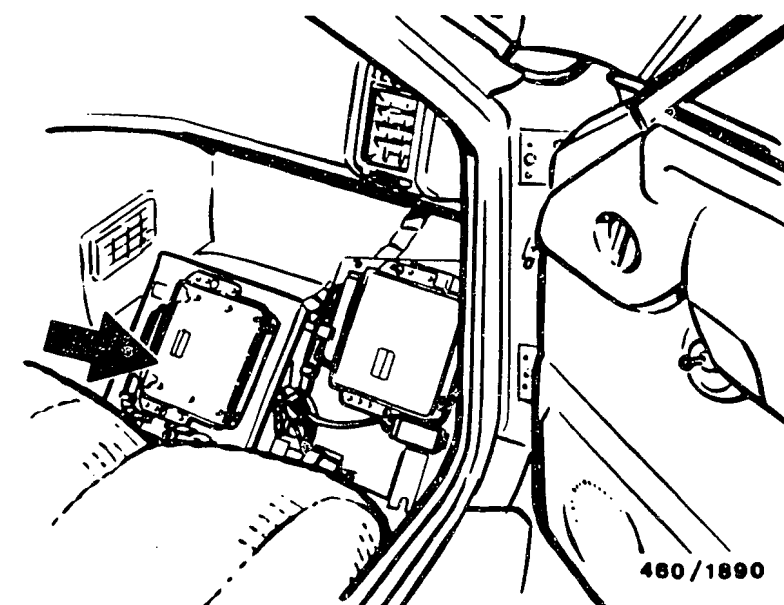
N>

Needle-movement sensor defective, replace nozzle-holder assembly as a complete unit.

Continued on next picture page



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SELF-DIAGNOSIS TEST PROGRAM (11) (CONTINUED 2)

Test 5: Signal pattern, needle-movement sensor

N>

Needle-movement sensor defective,
replace nozzle-holder assembly
as a complete unit.

For testing, use test
oscilloscope or Motortester.

When testing with Motortester,
press buttons for special input,
10 V, 100 ms (or %).

Run engine at idle speed.

Pull back rubber cap on cable
connector.

Connect tester with test leads
KDZS 0004 to connected multiple
butt connector.

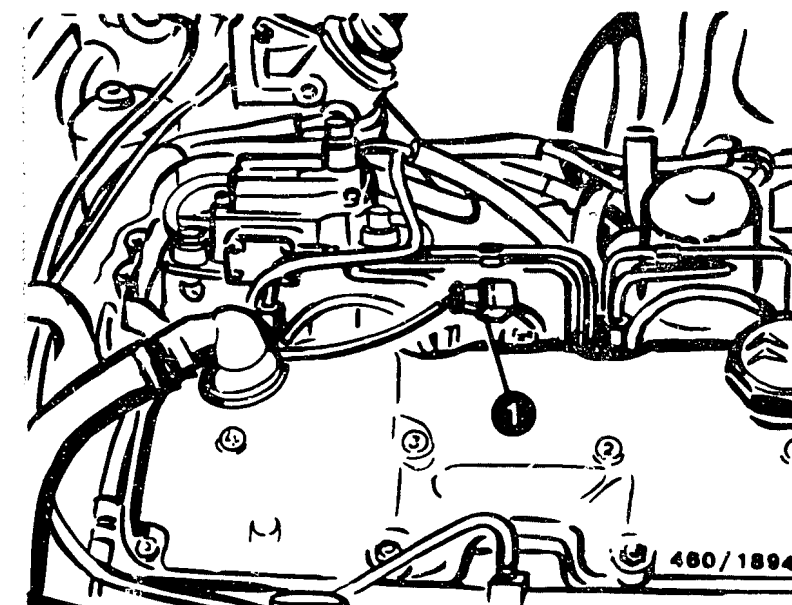
For signal pattern, see lower
illustration.

Set value: see brief instruc.

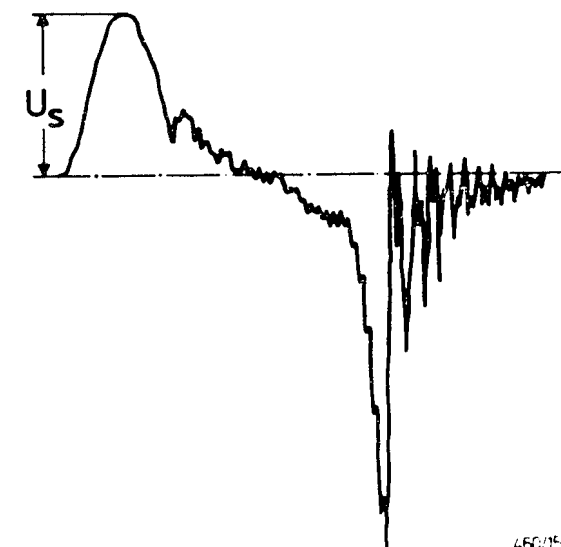
NOTE:

Voltage value (U_s) can
be measured accurately only
with a test oscilloscope.

Is signal pattern present and
is set value obtained?



1 = Multiple butt connector,
needle-movement sensor



Return to self-diagnosis
test table B23

SELF-DIAGNOSIS TEST PROGRAM (12)

Flashing code: 4.3

Component:
Solenoid valve, start of injection
(top picture, arrow)

Test 1: Short-circuit to ground

Disconnect multiple butt connector
(1, bottom picture) to solenoid
valve.

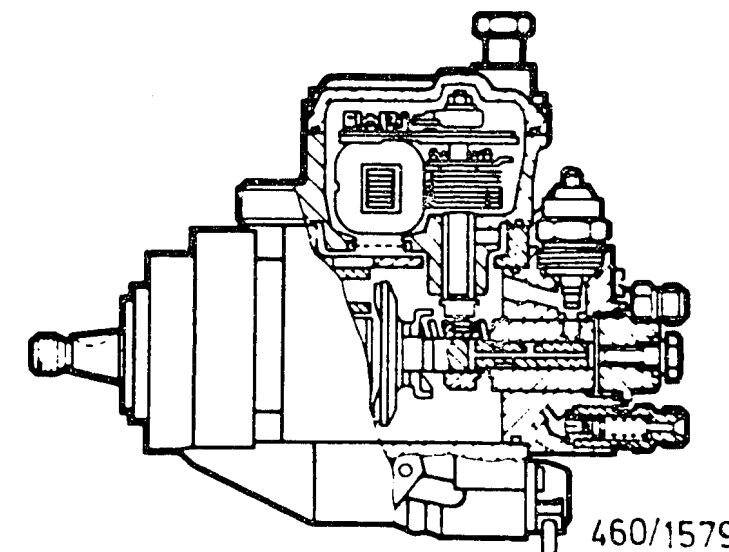
Connect multimeter with test leads
KDUM 0008 (2, bottom picture) to one
wiring post and ground in each case.

Set value: $> 1 \text{ M } \Omega$

Set value attained?

N>

Remove fuel-injection pump.
Replace solenoid-operated valve,
start of injection.



Test 2: Internal resistance

Connect multimeter with test leads
KDUM 0008 to both wiring posts of
multiple butt connector.

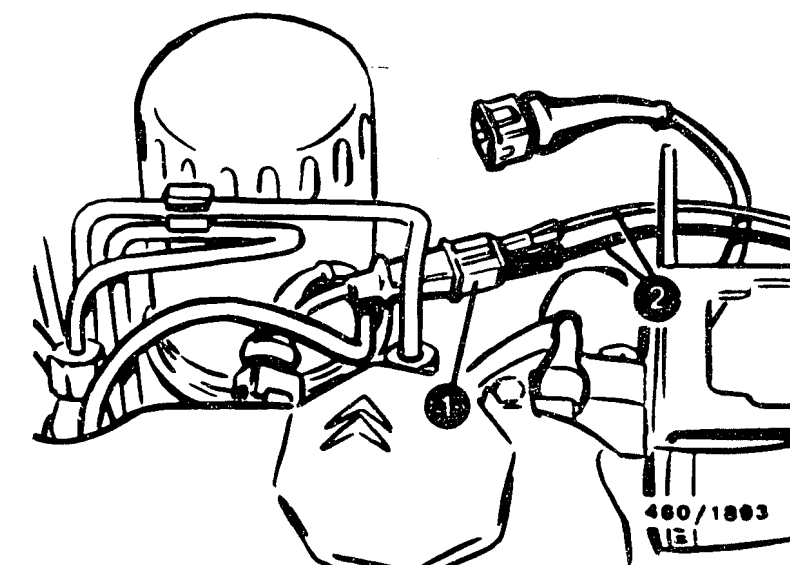
Set value: see brief instructions

Set value attained?

N>

Remove fuel-injection pump.
Replace solenoid-operated valve,
start of injection.

1 = Multiple butt connector to solenoid
valve, start of injection
2 = Test lead KDUM 0008



Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (12) (CONTINUED 1)

Test 3: Measuring-circuit voltage
Control unit

Connect multimeter with test leads
KDZS 0004 to disconnected connector.

Switch on ignition.

Set value: approx. 12 V

Set value attained?

N>

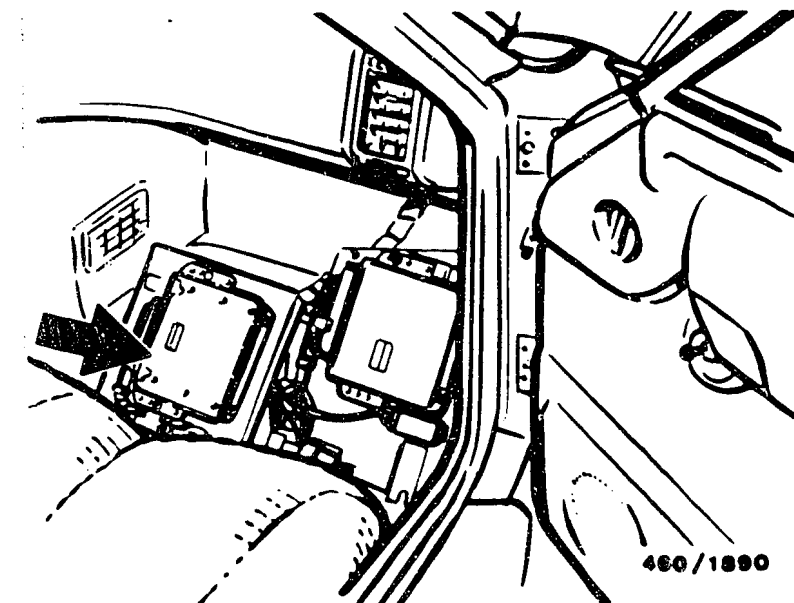
Switch off ignition.

Disconnect control-unit plug 2
(upper illustration). Test
leads from term. 1 and term. 2
(lower illustration) to
multiple butt connector with
test leads KDZS 0004 for open
circuit and/or contact resistance.

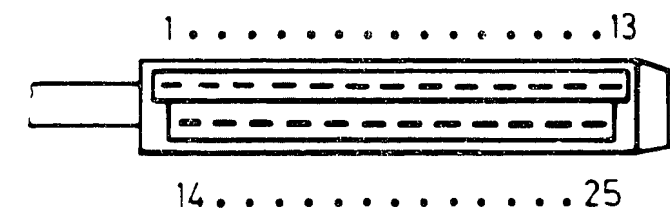
Bridge leads at cable connector
of solenoid-operated valve.

Set value: approx. 0 Ω

If set value is obtained,
replace control unit 2.



Arrow = Start-of-injection and
exhaust-gas-recirculation
control unit
(Designated control unit 2 in
these trouble-shooting instructions)



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Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (12) (CONTINUED 2)

Test 4: Actuation on/off ratio

Pull back rubber cap at connector (top picture, arrow).

Connect pocket tester with test leads KDZS 0004 to assembled multiple butt connector.

Set dwell-angle measuring range. Allow engine to idle.

Cooling-water temperature approx. 80° C.

Detach connector from needle-motion sensor.

Set value: see brief instructions

Attach connector of needle-motion sensor.

Set value: see brief instructions

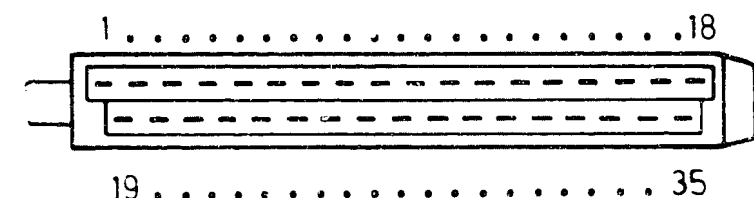
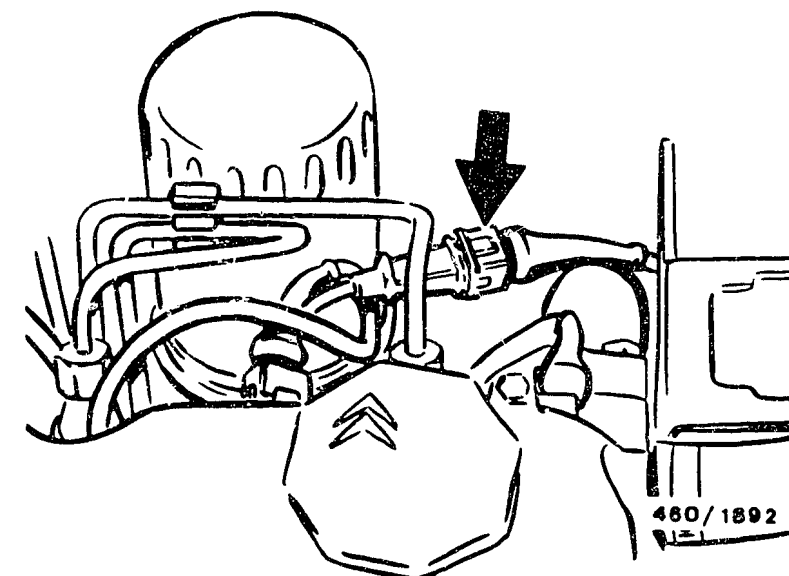
Does on/off ratio change when needle-motion-sensor plug is detached or engine speed is increased?

N>

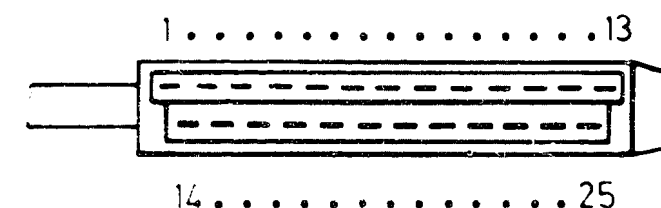
Detach control-unit plugs 1 and 2 (center and bottom pictures).

Test for open-circuit in lead term. 8 (control-unit plug 1) to lead term. 6 (control-unit plug 2). Eliminate open-circuit.

If there is no open-circuit, renew control unit 2.



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Continued on next picture page

E01



E02



V

Test 5: Function of
solenoid valve,
start of injection

N>

Coolant temperature < 30° C

Allow engine to idle.

Detach connector from needle-motion
sensor.

Disconnect multiple butt connector
from solenoid valve.

Can engine be heard to run harder
as a result of advance?

Remove fuel-injection pump.

Cause of fault e.g. solenoid valve
or timing device sticking.

Y

Return to self-diagnosis
test table B25

SELF-DIAGNOSIS TEST PROGRAM (13)

Flashing code : 5.1

Component:
Control-unit computer link
(stored fault)

Test 1:
Data lines of control unit
Note:
Fault is not present when test
is performed; particular attention
is therefore to be paid to:

- * Loose contacts at plug connections.
- * Dirty, corroded or pushed-back plug contacts.
- * Breaks in leads where leads are kinked or crushed.

Switch off ignition.
Detach control-unit plugs 1 and 2 (center picture).
Connect multimeter with test leads KDZS 0004 to terminals listed below (top picture).

Control-unit	/	Control-unit
plug 1		plug 2
term. 14	and	term 9
term. 15	and	term. 12

Move connecting leads of control units whilst performing test.

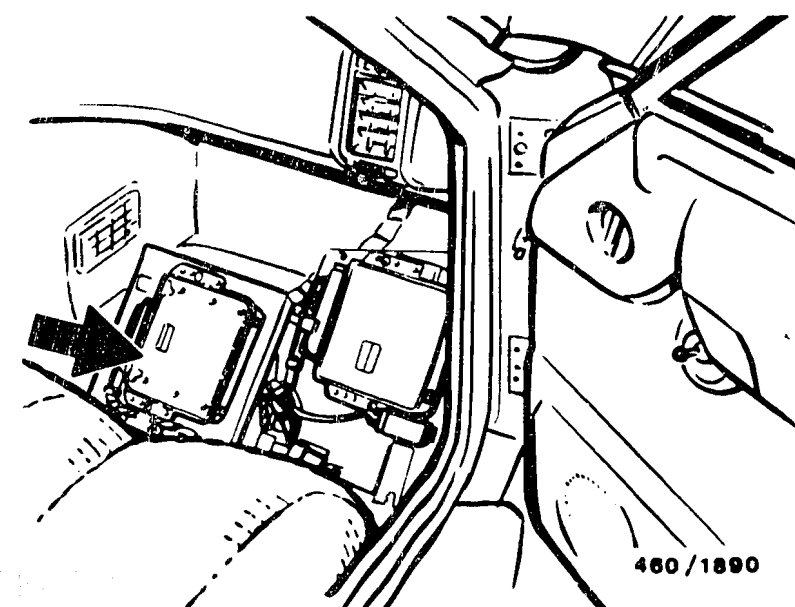
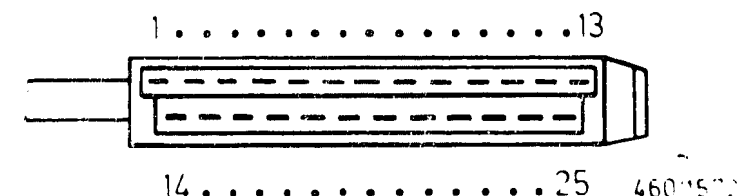
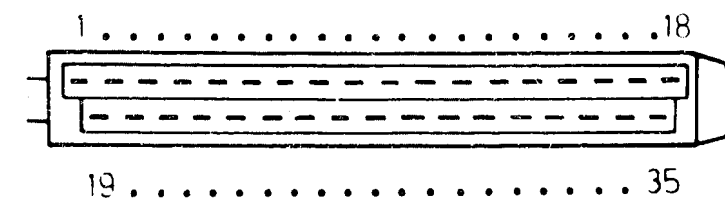
Set value: approx. 0 Ω

Set value attained?

N>

Test appropriate lead path for open circuit and/or contact resistance.

Eliminate open circuit and/or contact resistance.



Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (13) (CONTINUED 1)

V

Test 2: Control units

Connect cable connector to control units.

Switch on ignition.

Start engine and run at idle speed.

Activate self-diagnosis.

If flashing code 5.2 is not indicated, computer interface is O.K.

Switch off engine.

N>

Determine defective control unit by exchanging.

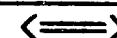
V

Return to self-diagnosis test table B25

E07



E08



SELF-DIAGNOSIS TEST PROGRAM (14)

Flashing code : 5.2

Component:
Control-unit computer link
(current fault)

N>

Test appropriate lead path for
open circuit and/or contact
resistance.

Eliminate open circuit and/or
contact resistance.

Test 1:

Data lines of control units

NOTE :

Fault is present when test is
performed.

Switch off ignition.

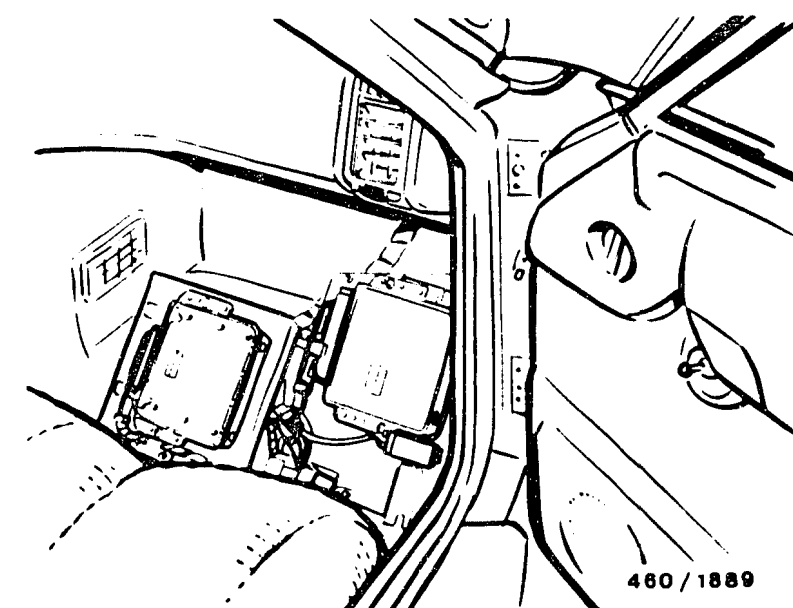
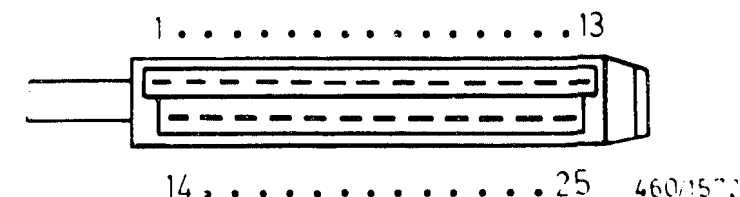
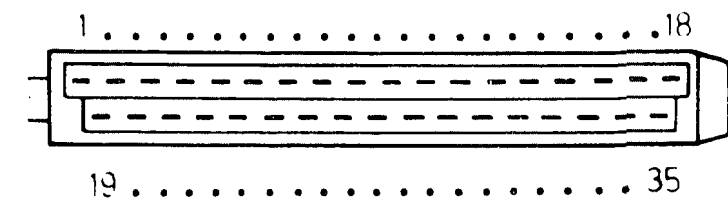
Detach control-unit plugs 1 and 2
(center picture).

Connect multimeter with test
leads KDZS 0004 to terminals listed
below (top picture).

Control-unit	/	Control-unit
plug 1		plug 2
term. 14	and	term. 9
term. 15	and	term. 12

Set value: approx. 0 Ω

Set value attained?



Continued on next picture page

SELF-DIAGNOSIS TEST PROGRAM (14) (CONTINUED 1)

V

Test 2: Control units

Connect cable connector to control units.

Switch on ignition.

Start engine and run at idle speed.

Activate self-diagnosis.

If flashing code 5.2 is not indicated, computer interface is O.K.

Switch off engine.

N>

Determine defective control unit by exchanging.

Y

Return to self-diagnosis test table B25

E11

<==>

E12

<==>

SELF-DIAGNOSIS TEST PROGRAM (15)

Flashing code : 5.2

Component:

Computer monitoring
Control unit 1

N>

Control unit 1 defective, renew

Can engine be started and operated
at an arbitrary speed with flashing
code 5.2 indicated?

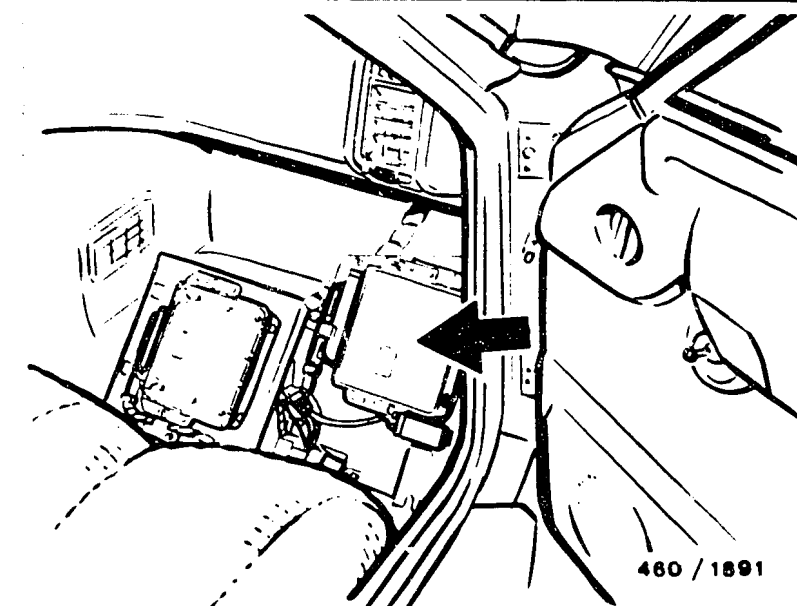
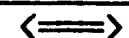
Y

Return to self-diagnosis
test table B27

E13



E14



Arrow = Delivery and road-speed
control unit
(Designated control unit 1 in
these trouble-shooting instruc-
tions)

SELF-DIAGNOSIS TEST PROGRAM (16)

Flashing code: Continuously lit lamp

Component:
Computer monitoring
Control unit 2

Test prerequisite:

Indicator lamp of self-diagnosis
lights up continuously and no
flashing code is indicated by
stimulating self-diagnosis.

Exhaust gas recirculation dis-
connected.

Test: Measuring-circuit voltage
Control unit 2

Detach multiple butt connector of
solenoid valve (start of injection).

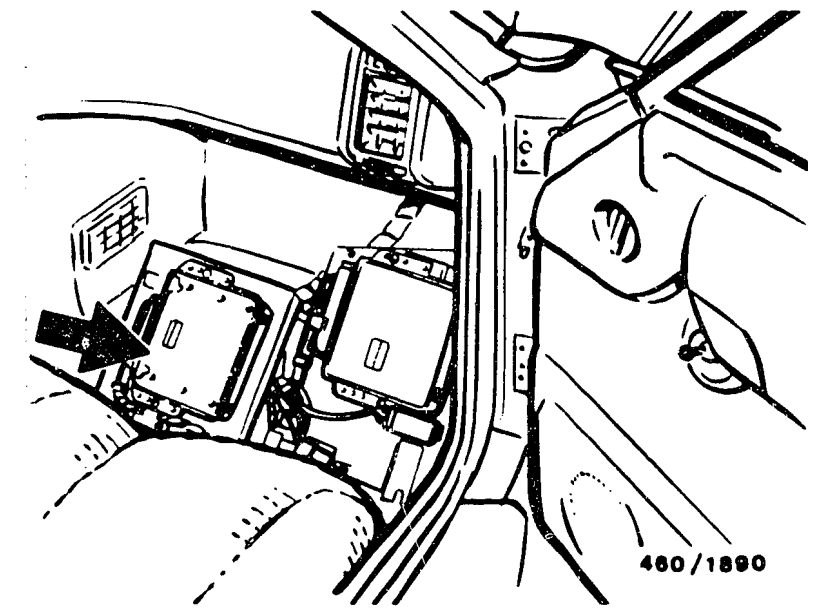
Connect multimeter with test leads
KDZS 0004 to disconnected connector.

Switch on ignition.

Set value approx. 12 V

Set value attained?

Control unit 2 defective, renew.



Arrow = Start-of-delivery and
exhaust-gas-recirculation
control unit
(Designated control unit 2 in
these trouble-shooting instructions)

Return to self-diagnosis
test table B27

TROUBLE-SHOOTING PROGRAM (1)

Component/function:

Voltage supply -
Control units

Test 1: Reverse-polarity protection
relay (top picture, arrow)

Connect multimeter with
commercially available test leads
and test prods to output of reverse-
polarity protection relay
(term. 88a/b).

Switch on ignition.

Set value: 11.5...14.5 V

Set value attained?

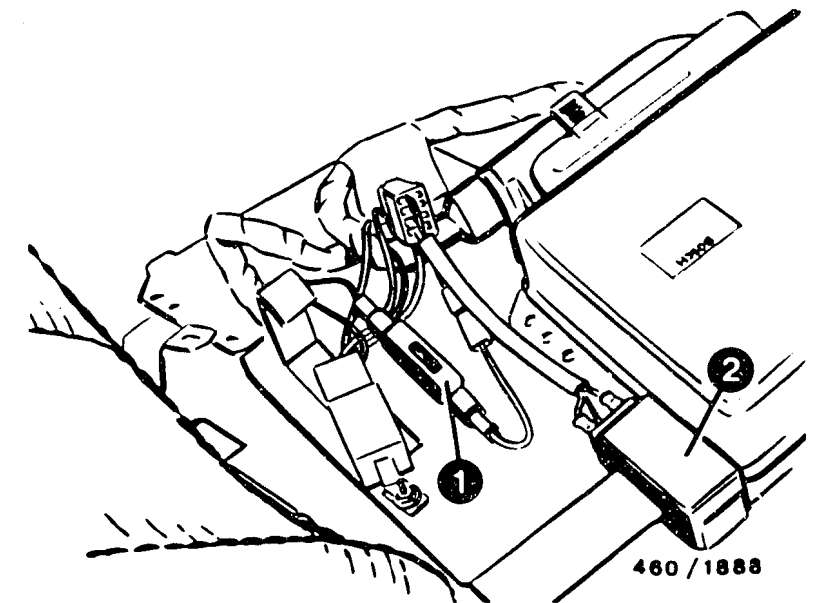
N>

Test function and actuation of
reverse-polarity protection relay:

- + 15 to term. 86
- + 30 to term. 30/88
- 31 to term. 85
- + 30 to term. 88a/b

Eliminate any lead open-circuit.

If there is no voltage at term. 86,
test and if necessary replace
reverse-polarity protection diode.
Test conduction path.



1 = Reverse-polarity protection diode
2 = Reverse-polarity protection relay

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (1) CONTINUED (1)

Test 2:
Voltage supply, control units

Switch off ignition.

Detach control-unit plugs 1 and 2.

Connect multimeter with test leads
KDZS 0004 to terminals listed below.

Control-unit plug 1

Term. 2 (+) and 19 (-)

Term. 3 (+) and 20 (-)

Control-unit plug 2

Term. 5 (+) and 14 (-)

Term. 19 (+) and 15 (-)

Switch on ignition.

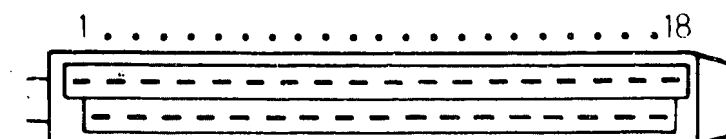
Set value: 11.5...14.5 V

Set value attained?

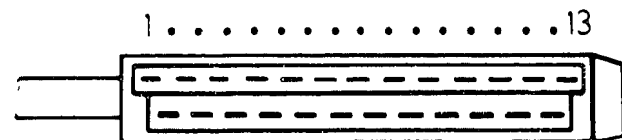
Test appropriate lead path for
open circuit.

Eliminate open circuit.

Return to trouble-shooting chart
B06



19 35



14 25 460/1572

TROUBLE-SHOOTING PROGRAM (2)

Component/function:
Switch (brake)

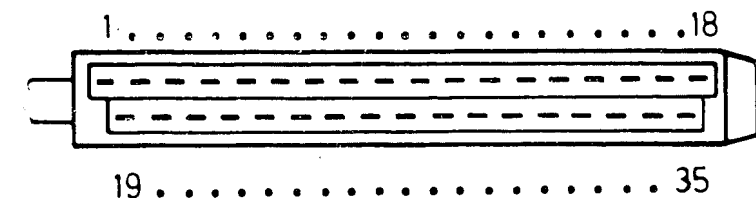
Test 1:

Does stop lamp light up when brake pedal is actuated?

N>

Test voltage supply at switch.

If voltage applied to switch, renew switch.



4601573

Test 2: Brake signal at control unit

Switch off ignition.

Detach control-unit plug 1.

Connect multimeter with test leads KDZS 0004 to control-unit plug 1 term. 19 (-) and term. 11 (+) as well as term. 27 (+) (top picture).

Switch on ignition and press brake pedal.

Set value: 11.5...14.5 V

Set value attained?

N>

No voltage at term. 11; test for open-circuit in lead. Eliminate open-circuit.

No voltage at term. 27; test for open-circuit in lead. If there is no switch, the free cable ends must be jumpered.

Note :

There is no voltage at term. 27 if there is no cable link and brake pedal is pressed.

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (3)

Component/function
Exhaust gas recirculation

N>

EGR valve defective, renew.

Test 1: Exhaust-gas-recirculation valve

Prerequisite:

- Engine at operating temperature approx. 80°C
- Check routing of leads (top picture)

Switch on ignition

- Test vacuum supply (>350 mbar; top picture, 1)

Switch off ignition

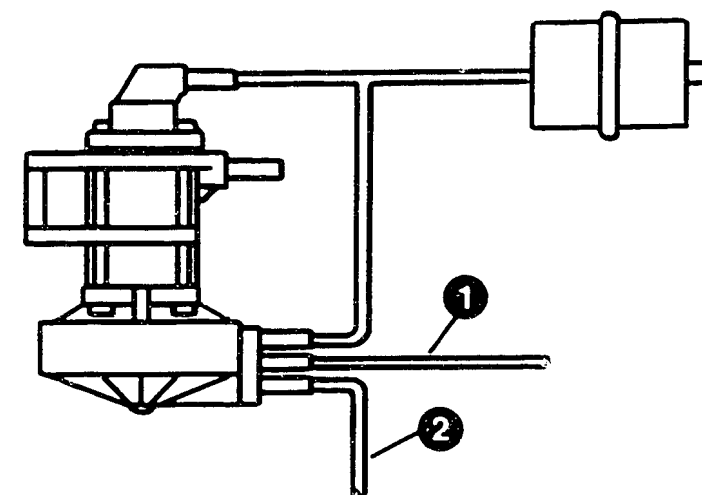
Allow engine to idle.

- Actuation on/off ratio present at pressure transducer (bottom picture, arrow)

Switch off engine

- Test EGR valve with Mityvac pump (test pressure approx. >350 mbar). Valve must be clearly heard to close. Repeat test sequence several times.

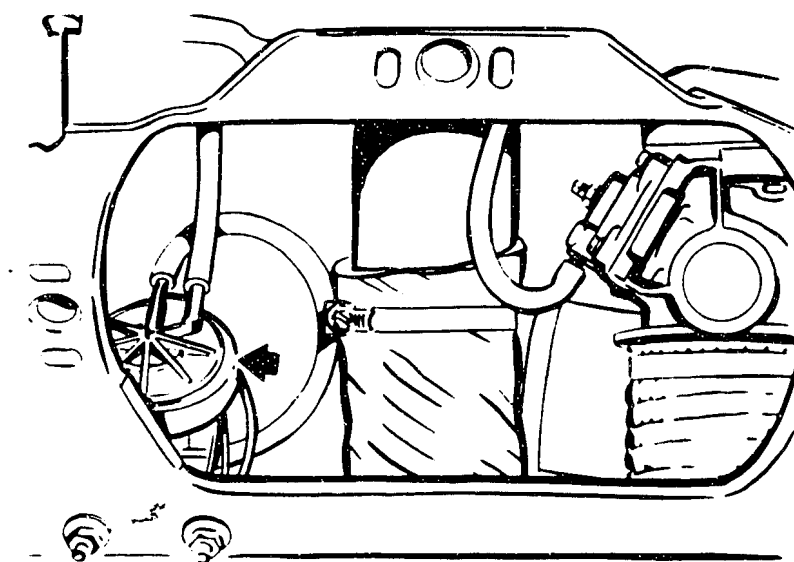
Does exhaust-gas-recirculation valve open?



460/1887

1 = Vacuum supply (inlet)

2 = Vacuum supply (EGR valve, throttle-valve assembly)



460/1886-2

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (3) CONTINUED (1)

Test 2: Throttle valve
Intake air

N>

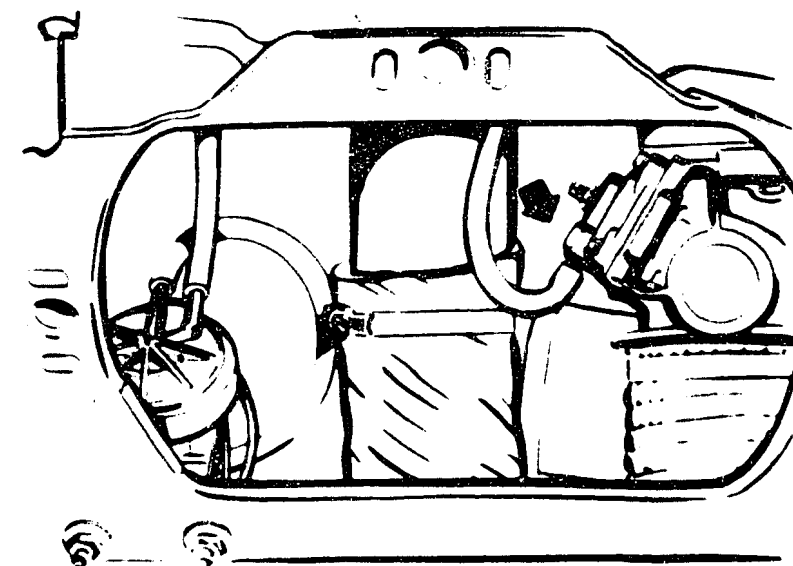
Throttle valve defective, renew.

Connect Mityvac pump to throttle-
valve assembly (picture, arrow).

Generate vacuum with pump
(throttle valve closes).

Detach pressure hose.

Is throttle valve heard to close?



Return to trouble-shooting chart
B06

TESTING PREHEATING SYSTEM

Tester required

VA tester e.g. ETT 011.00
 Part. no. 0 684 101 100

Workshop information

We recommend replacing R-type sheathed-element glow plugs every 45 000 km.

Note:

Incorrect adjustment of the start of delivery can considerably reduce the service life of the sheathed-element glow plug.

Preheating times

The length of time for which the preheating system is switched on is a function of the ambient temperature.

For production reasons:
continued on the following
coordinate.

TESTIN PREHEATING SYSTEM 1

Test voltage supply of R-type sheathed-element glow plugs

N>

Connect voltmeter to R-type sheathed-element glow plug with respect to ground. Set glow-plug and starter switch to ON position and then to start position. A minimum voltage of 10 V must be indicated for at least 11 seconds (depending on temperature). The system switches off automatically upon completion of this period.

Minimum voltage present?

1. Voltage less than 10 V, then test power circuit (battery +) as well as term. 1 and term. 5 of glow-duration unit for voltage dip. Eliminate voltage dip.
2. If no voltage present, test for open-circuit in lead from R-type sheathed-element glow plug to glow-duration unit term. 5. Eliminate open-circuit. If there is no open-circuit, continue with Coordinate F07/F09. Continuation here not necessary.

Test start indicator lamp

N>

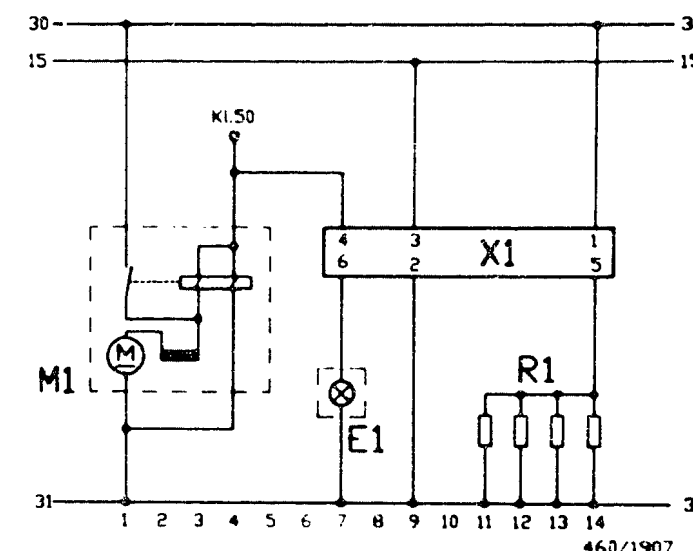
Set glow-plug and starter switch to ON position and then to start position.

Start indicator lamp must light up.

Does start indicator lamp light up?

1. Test for open-circuit in lead from glow-plug and starter switch term. 15 to glow-duration unit term. 3. Eliminate open-circuit.
2. Test for open-circuit in lead from glow-duration unit term. 6 including start indicator lamp and its ground connection. Eliminate open-circuit.
3. Test for open-circuit in ground lead term. 2 from glow-duration unit. Eliminate open-circuit.

Continued on next picture page



E1 = Preheating indicator lamp
M1 = Starting motor
R = Sheathed-element glow plugs
X1 = Glow-duration unit

TESTIN PREHEATING SYSTEM 2

Test preheating time

Set glow-plug and starter switch to ON position and then to start position.

The preheating time (start indicator lamp lights up) must be as follows given an ambient temperature of:

- 0° C - 7...11 seconds
- + 10° C - 6...10 seconds
- + 20° C - 4... 8 seconds
- + 30° C - 3... 6 seconds
- + 40° C - 1... 5 seconds

Preheating time (seconds) O.K.?

Renew glow-duration unit.

Test safety circuit

Connect voltmeter to R-type sheathed-element glow plug with respect to ground. Set glow-plug and starter switch to ON position and then to start position.

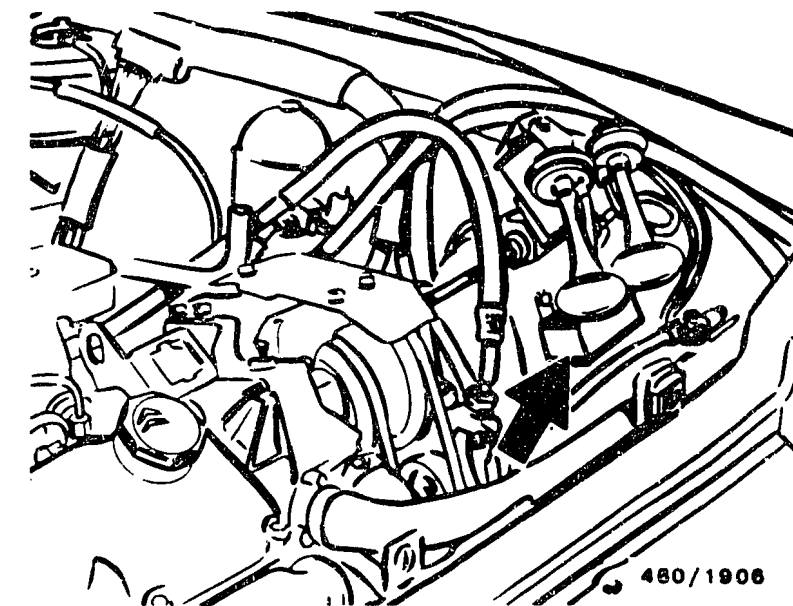
Voltmeter must give a voltage reading as follows at an ambient temperature of:

- 0° C for 16...20 seconds
- + 10° C for 15...19 seconds
- + 20° C for 14...18 seconds
- + 30° C for 13...17 seconds
- + 40° C for 12...16 seconds

The voltmeter reading must be 0 V following completion of the prescribed duration.

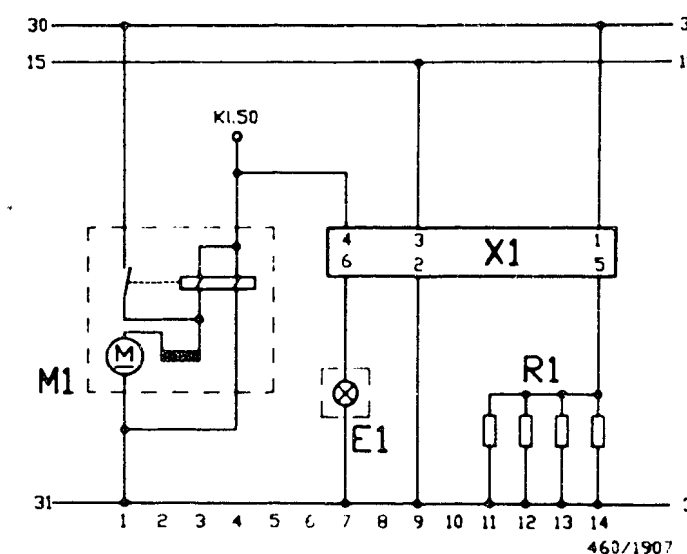
Voltmeter reading 0 V after specified time?

Renew glow-duration unit.



Installation position of glow-duration unit

E1 = Preheating indicator lamp
M1 = Starting motor
R = Sheathed-element glow plugs
X1 = Glow-duration unit



Continued on next picture page

TESTIN PREHEATING SYSTEM 3

Test glow with starting-motor actuation

Connect voltmeter to R-type sheathed-element glow plug with respect to ground.
Set glow-plug and starter switch to start position.

Voltmeter reading must be between 6...10 V.

Voltage present?

N>

1. Test for open-circuit in lead from glow-plug and starter switch term. 50 to glow-duration unit term. 4.
Eliminate open-circuit.

2. If Item 1 O.K., renew glow-duration unit.

Test R-type sheathed-element glow plugs

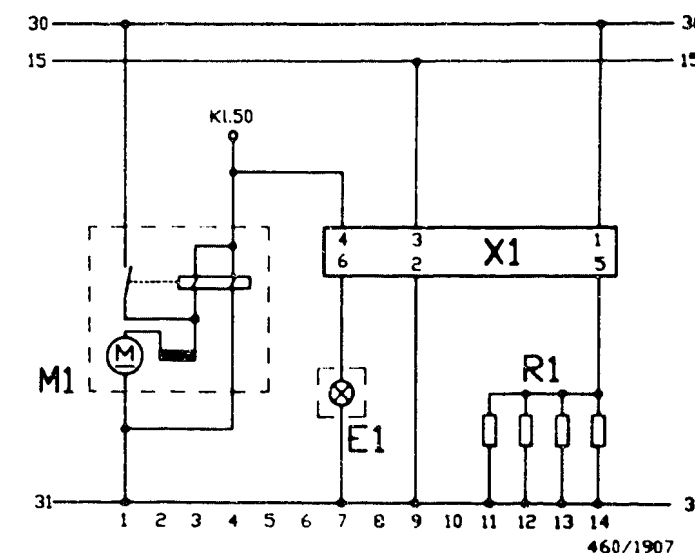
Use ohmmeter to individually test R-type sheathed-element glow plugs for continuity.
R-type sheathed-element glow-plug continuity?

N>

Renew R-type sheathed-element glow plug.

Preheating system O.K.?

Testing as of F07 not necessary.



E1 = Preheating indicator lamp
M1 = Starting motor
R = Sheathed-element glow plugs
X1 = Glow-duration unit

TESTIN PREHEATING SYSTEM 4

Test voltage at glow-duration unit term. 3

Connect voltmeter to glow-duration unit term. 3 with respect to ground. Set glow-plug and starter switch to ON position and then to start position. Voltmeter must indicate battery voltage. Battery voltage present?

N>

Test for open-circuit in lead from glow-duration unit term. 3 to glow-plug and starter switch.

Eliminate open-circuit.

Y

Test ground lead term. 2 from glow-duration unit.

Connect voltmeter to glow-duration unit term. 2 and battery +. Voltmeter must indicate battery voltage. Battery voltage present?

N>

Test for open-circuit in ground lead term. 2 from glow-duration unit.

Eliminate open-circuit.

Y

Test voltage at glow-duration unit term. 1

Connect voltmeter to glow-duration unit term. 1 with respect to ground. Voltmeter must indicate battery voltage. Battery voltage present?

N>

Test for open-circuit in lead from glow-duration unit term. 1 to battery +.

Eliminate open-circuit.

Y

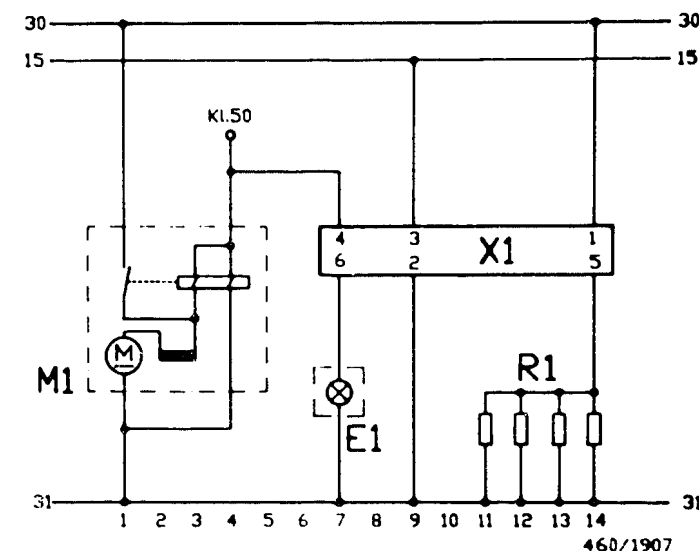
Voltage now present at R-type sheathed-element glow plug?

N>

Renew glow-duration unit.

Y

Continued on next picture page



E1 = Preheating indicator lamp

M1 = Starting motor

R = Sheathed-element glow plugs

X1 = Glow-duration unit

TESTIN PREHEATING SYSTEM 6

Test safety circuit

Connect voltmeter to R-type sheathed-element glow plug with respect to ground. Set glow-plug and starter switch to ON position and then to start position. Voltmeter must give a voltage reading as follows at an ambient temperature of:

- 0° C for 16...20 seconds
- + 10° C for 15...19 seconds
- + 20° C for 14...18 seconds
- + 30° C for 13...17 seconds
- + 40° C for 12...16 seconds

The voltmeter reading must be 0 V following completion of the prescribed duration.

Voltmeter reading 0 V after specified time?

N>

Renew glow-duration unit.

Test glow with starting-motor actuation.

Connect voltmeter to R-type sheathed-element glow plug with respect to ground. Set glow-plug and starter switch to start position. Voltmeter reading must be between 6...10 V.

Voltage present?

N>

1. Test for open-circuit in lead from glow-plug and starter switch term. 50 to glow-duration unit term. 4. Eliminate open-circuit.

2. If Item 1 O.K., renew glow-duration unit.

Test R-type sheathed-element glow plugs.

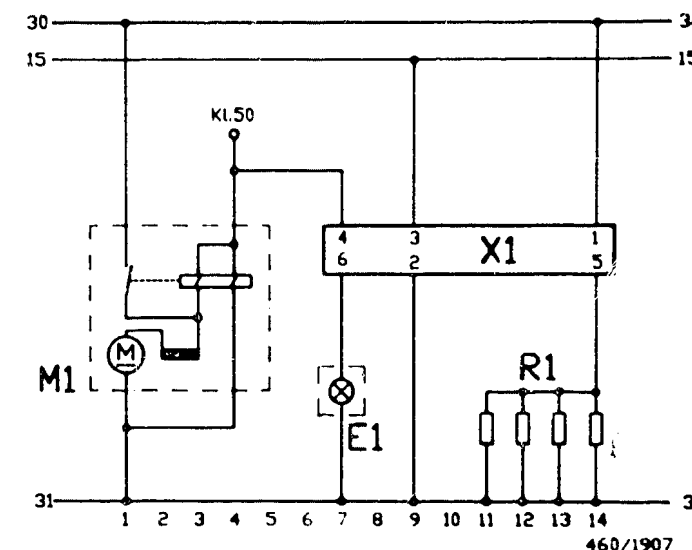
Use ohmmeter to test R-type sheathed-element glow plugs individually for continuity.

R-type sh.-element glow-plug contin.?

N>

Renew R-type sheathed-element glow plug.

Preheating system O.K.?

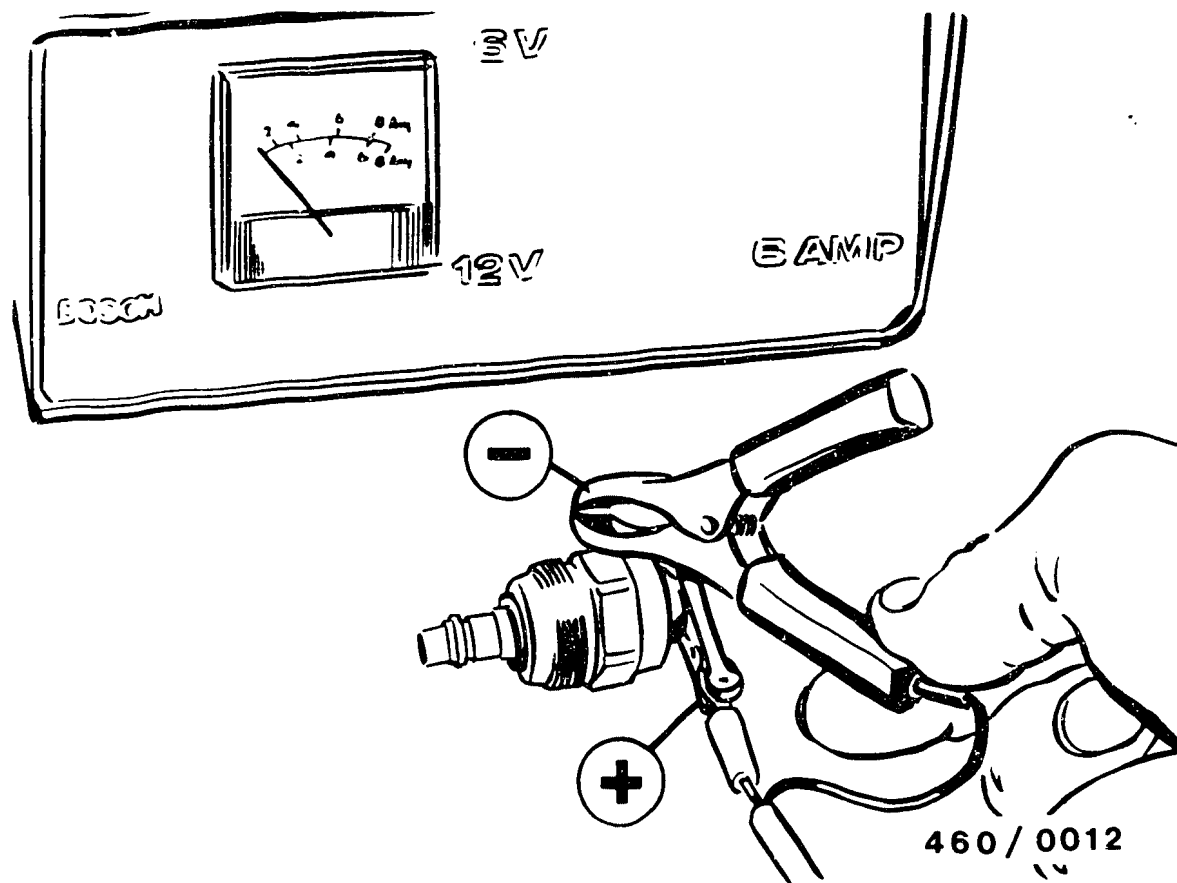


E1 = Preheating indicator lamp

M1 = Starting motor

R = Sheathed-element glow plugs

X1 = Glow-duration unit



TESTING FUNCTION OF SHUTOFF DEVICE

Engine doesn't start.

Check whether solenoid valve is supplied with voltage (min. 10 V) when ignition is switched on.

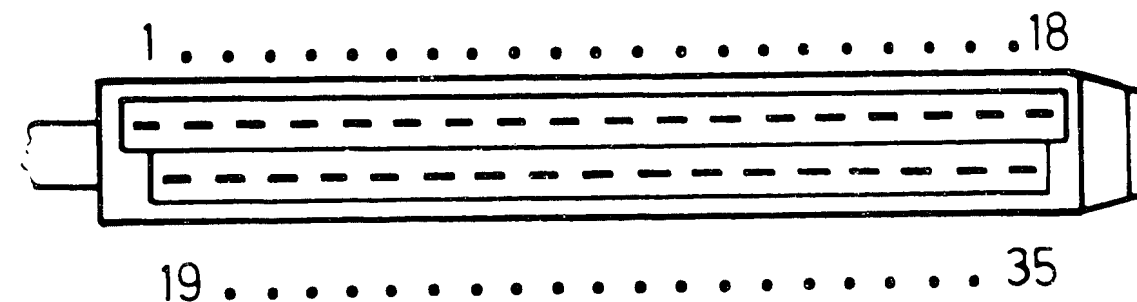
If voltage is present, remove solenoid valve.

Pay attention to cleanliness!

Check function of solenoid valve following removal.

Note:

When removed, solenoid valve may only be briefly supplied with voltage since there is no fuel cooling.



460/1573

No voltage at solenoid valve:

Prerequisite:

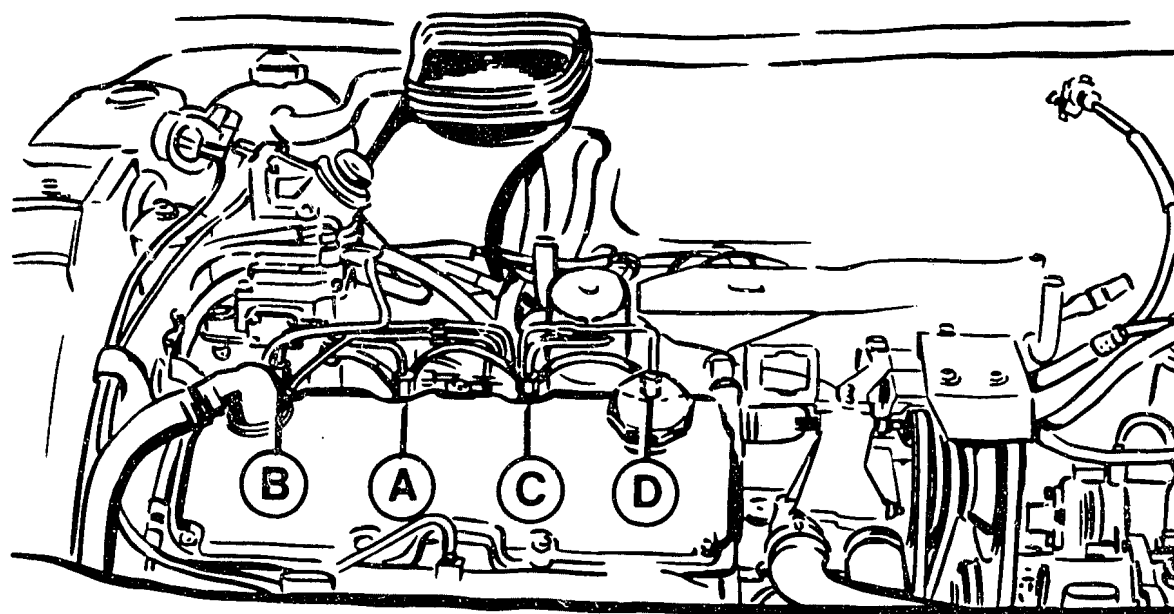
Injected-quantity adjuster and control-collar travel sensor O.K.

Detach connector at control-unit plug 1.

* Test for open-circuit in lead term. 4 from control-unit plug 1 to solenoid valve.

Eliminate open-circuit.

* If there is no open-circuit, renew control unit 1.



460 /1865

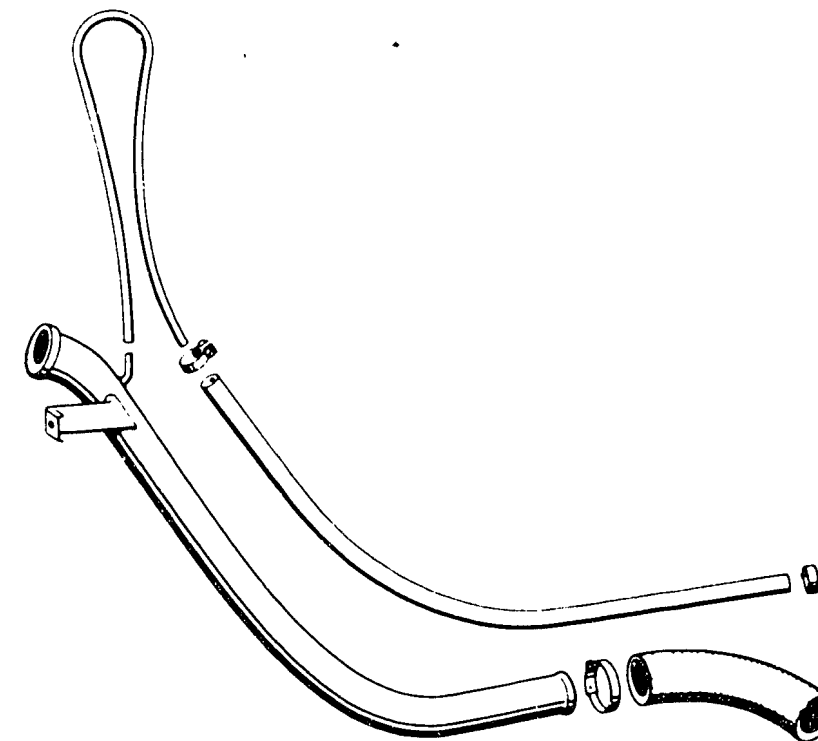
CHECKING FUEL-INJECTION-TUBING CONNECTIONS

The fuel-injection tubes are connected by way of clips so as to preclude mix-ups regarding outlets.

Should any doubts nevertheless arise, check the tube connections in accordance with the above diagram.

The letters A - D indicate the manner in which the fuel-injection-pump outlets are assigned to the individual engine cylinders.

Return to trouble-shooting chart B04



460/0511

CHECKING TANK VENTILATION

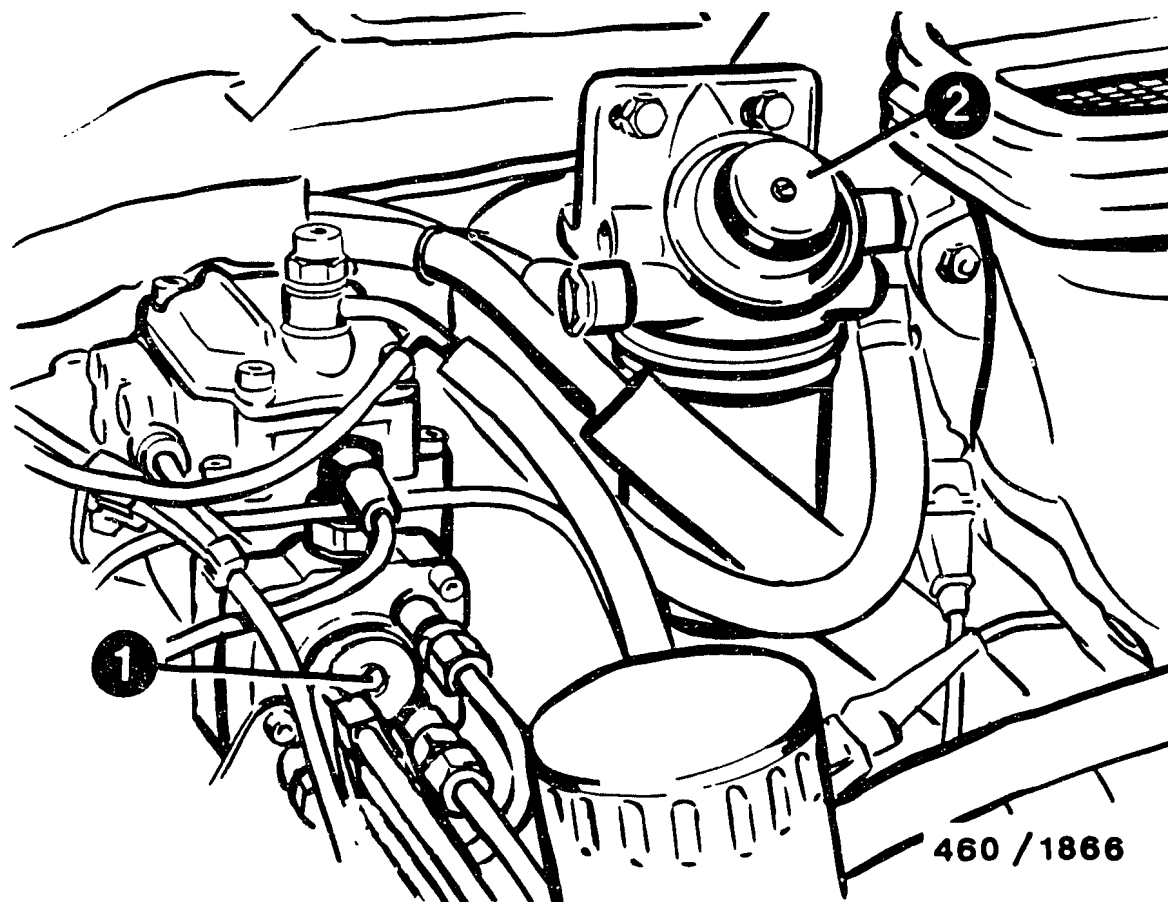
Open filler cap.

The tank ventilation is defective if the fault no longer occurs after the filler cap has been opened.

Remove tank-ventilation hoses (picture) and check for clogging or constriction.

If necessary, check fitting at tank.

Return to trouble-shooting chart B04



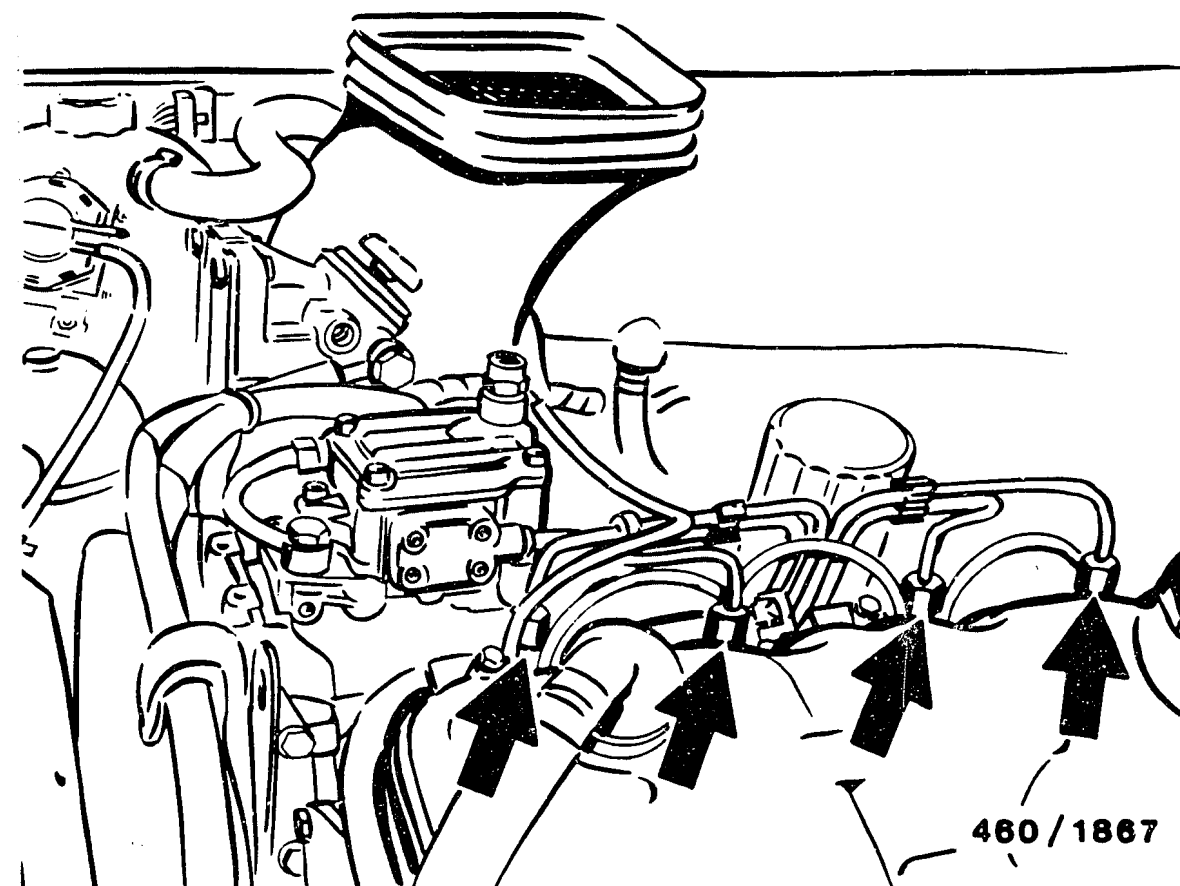
- 1 = Bleeder screw
2 = Hand pump

BLEEDING FUEL SYSTEM

Loosen bleeder screw and actuate hand pump until there are no bubbles in fuel as it emerges.

Tighten bleeder screw.

Actuate hand pump again until resistance is felt.



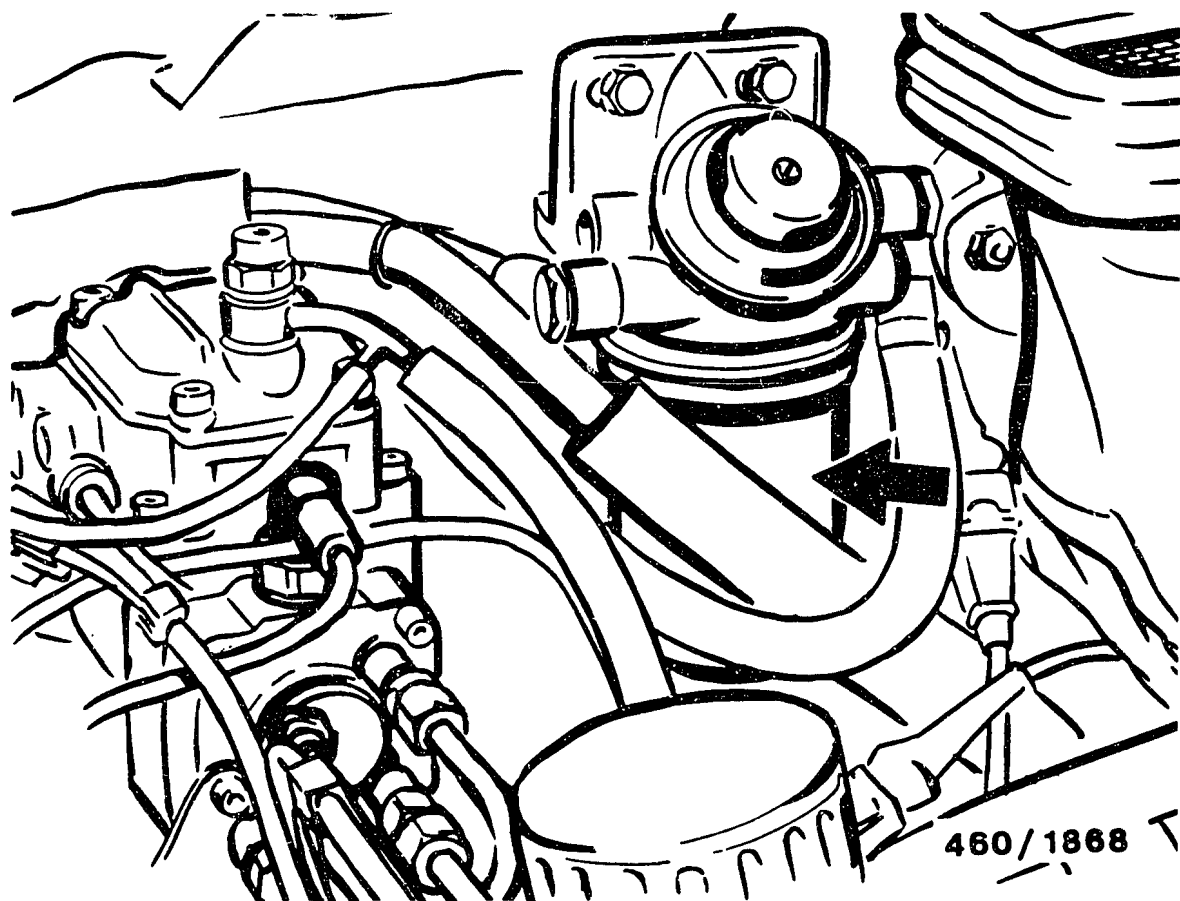
Loosen union nuts of fuel-injection tubing at injection-nozzle holders (see picture, arrows).

Actuate starting motor of engine without preheating until fuel emerges at union nuts of injection-nozzle holders.

Tighten union nuts.

Actuate starting motor until engine starts.

Return to trouble-shooting chart B04



RENEWING AND DRAINING FILTER BOX

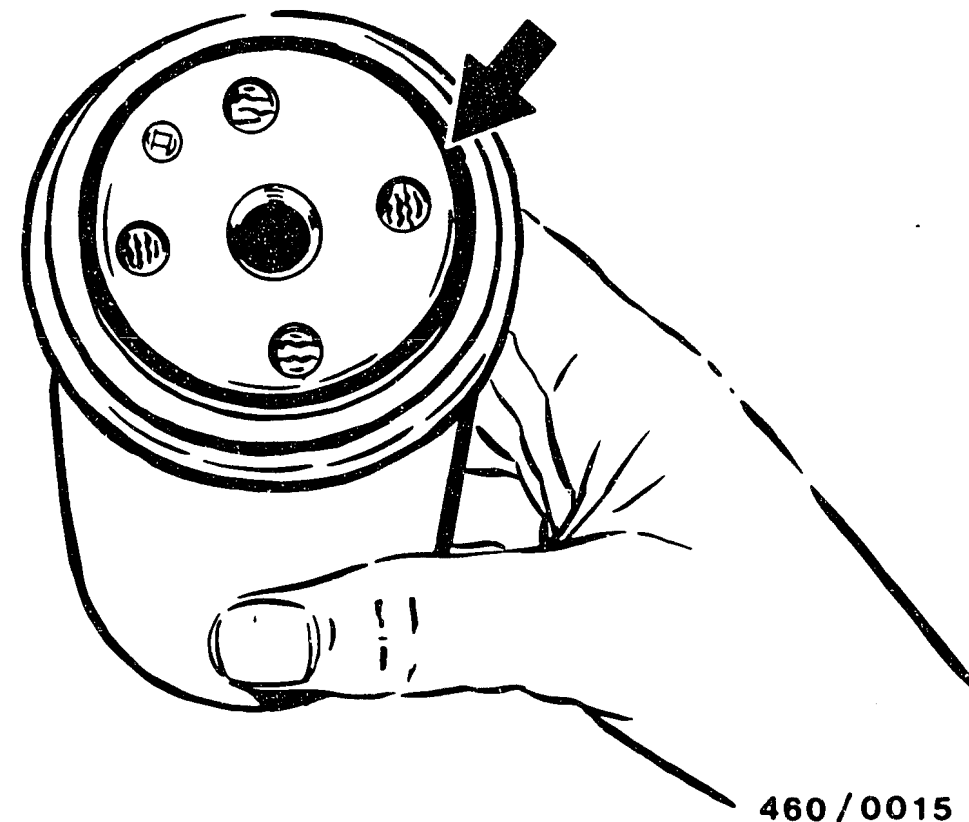
Renewing filter box

Detach plug at water level sensor.
Screw fuel filter (see picture, arrow) out of filter cover.

Loosen filter box with special wrench, e.g. Matra W 167.

Catch fuel as it emerges.

Screw water level sensor out of bottom of filter box.

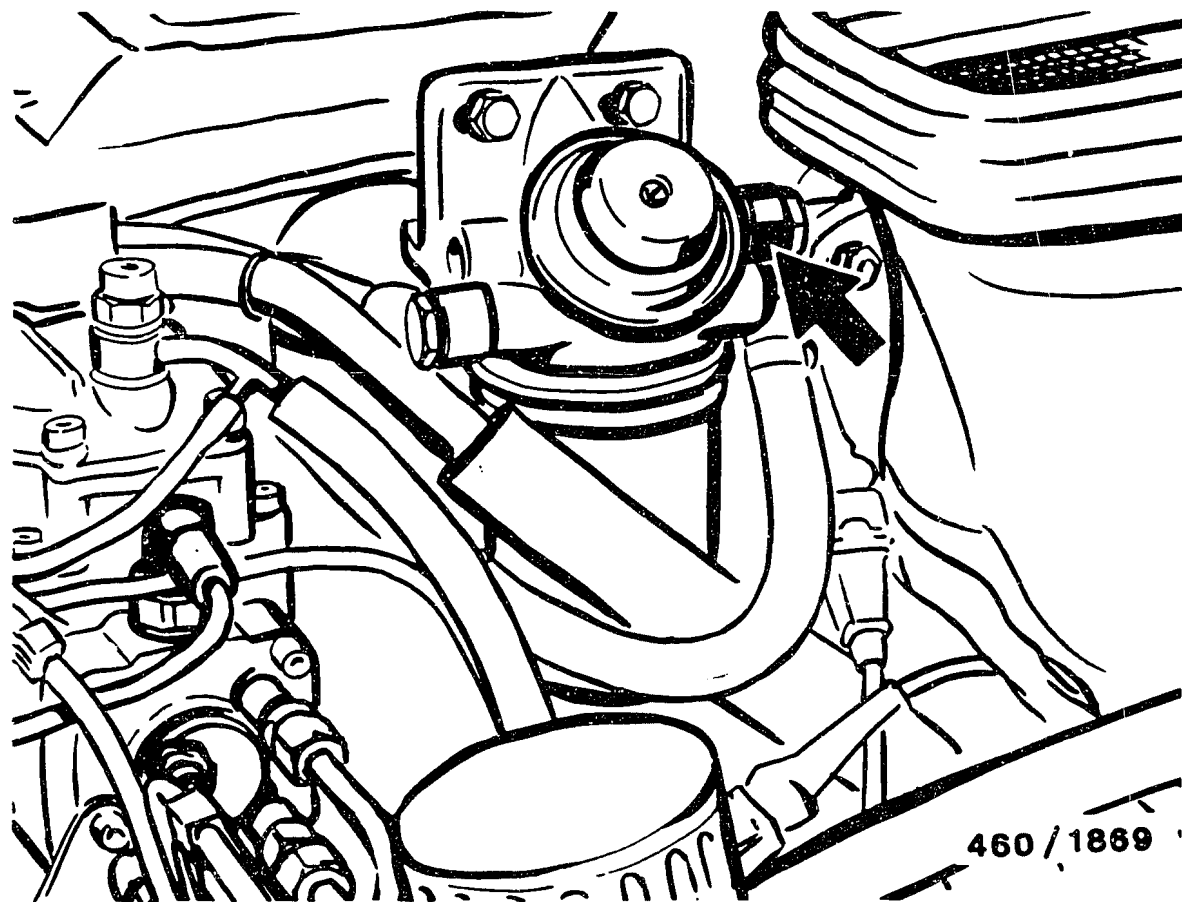


Apply diesel fuel to rubber seal (see picture, arrow) of new filter box.

Screw filter box into cover by hand and secure.

Check fuel filter for leaks.

When using winter fuel, kerosene may have to be added in accordance with the specifications of the vehicle manufacturer.



Drain fuel filter.

Loosen inlet-union screw at fuel filter outlet
(picture, arrow).

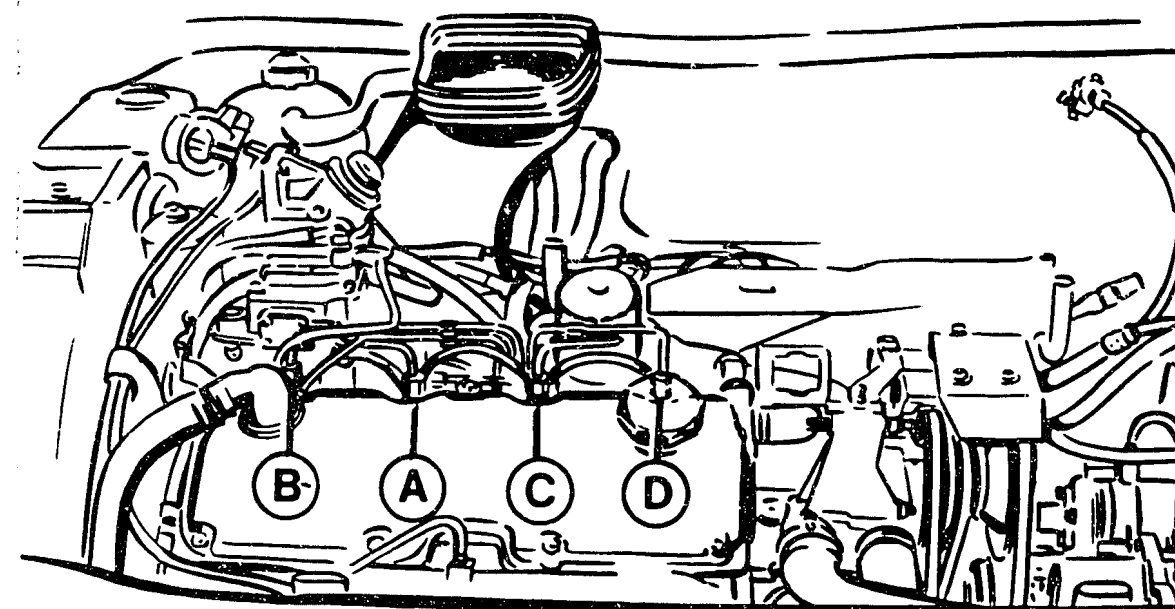
Detach water level sensor on bottom of filter and drain
off water.

Catch liquid in a vessel.

Screw on water level sensor, tighten inlet-union screw
and check for leaks.

Vent fuel filter if applicable.

Return to trouble-shooting chart B04



460 / 1865

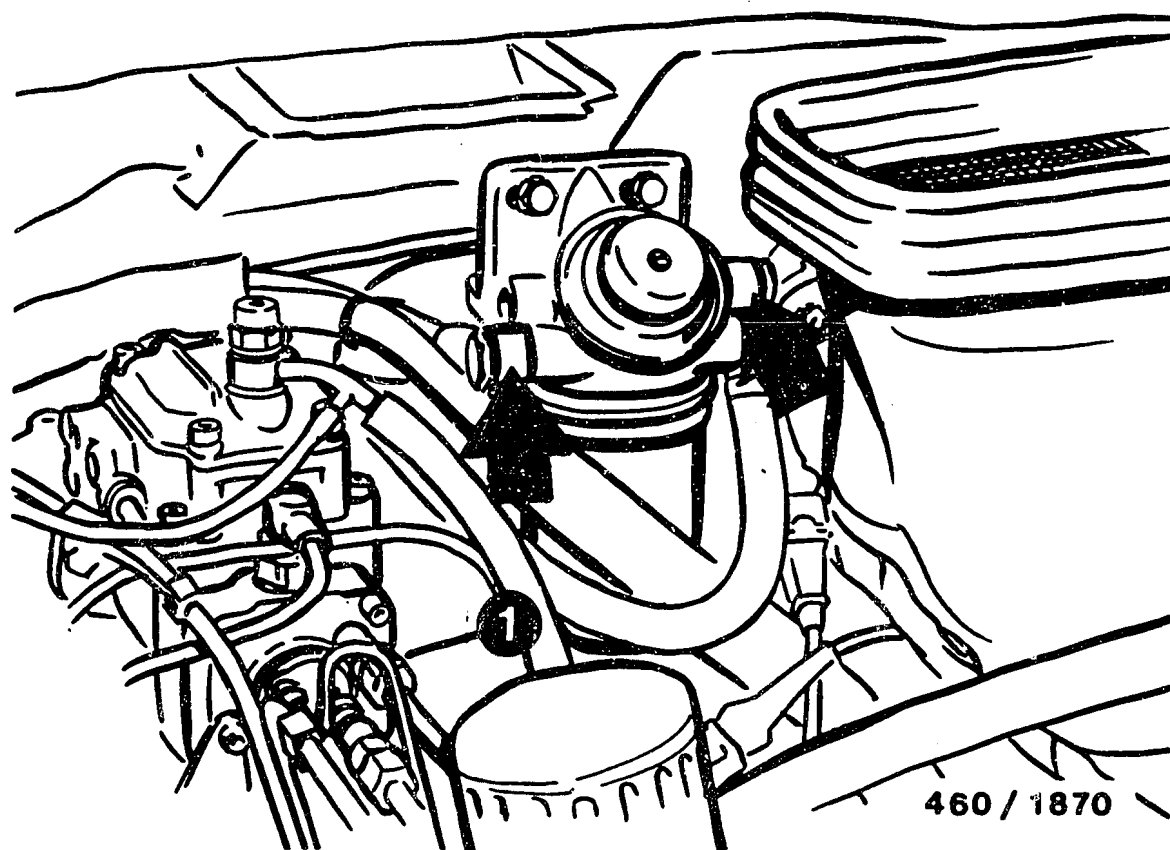
TESTING FUEL-INJECTION SYSTEM FOR LEAKS

Perform leak test with engine at operating temperature.

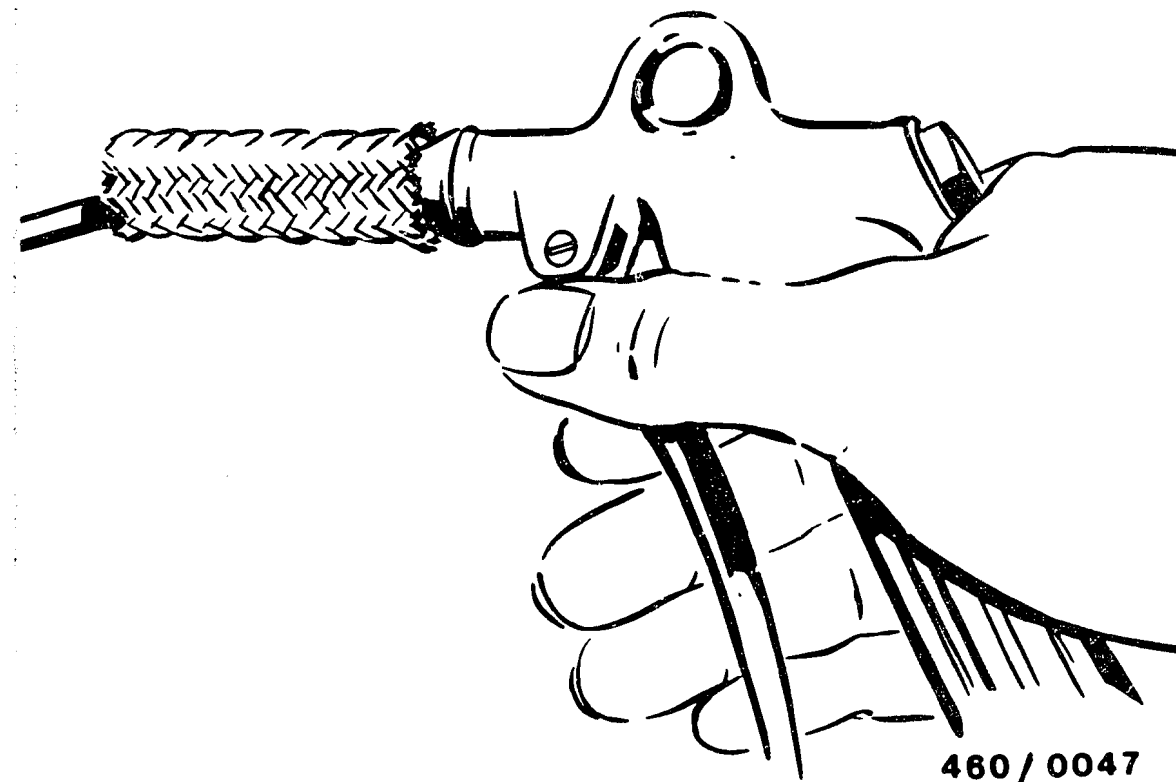
Examine all connections of fuel lines.

Pay particular attention to the following:

* Connections at injection-nozzle holders (A...D).



* Connections at fuel filter
(see picture, arrows).
1 = Delivery valve holder



TESTING FUEL LINES

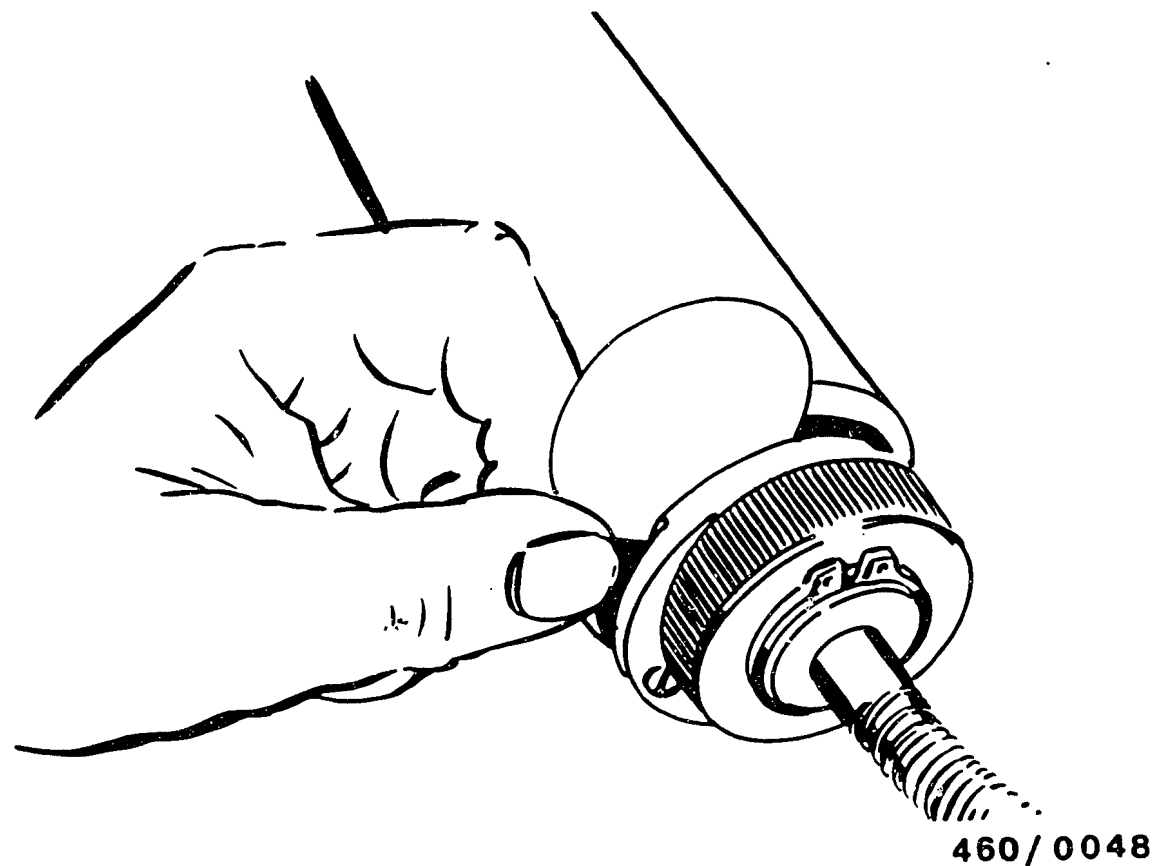
Visually inspect fuel lines about which complaints have been received.

Remove the fuel line in question if there are no signs of crushing or kinking.

Test fuel line for blockages using compressed air and clean it if necessary.

For blowing out the fuel lines, use can be made of a suitable piece of tubing as a lateral seal.

Return to trouble-shooting chart B04



SMOKE MEASUREMENT - TESTING AIR FILTER

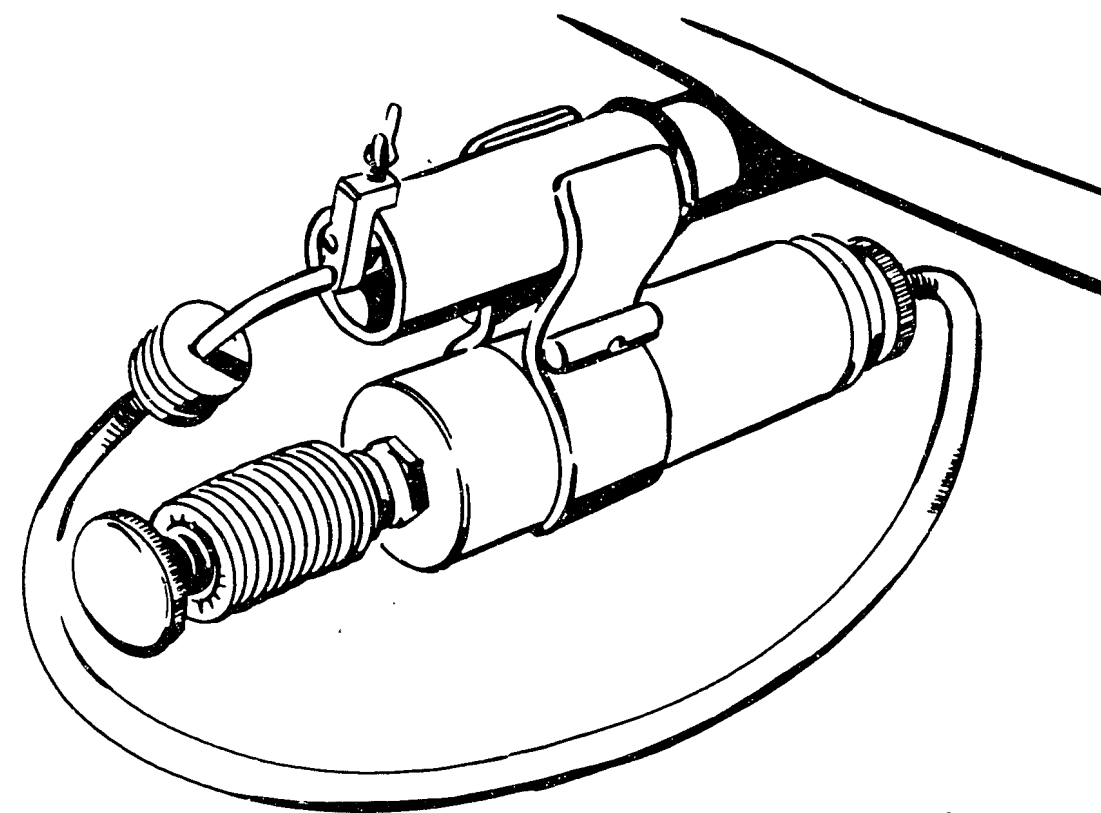
Test set-up

Smoke measurements are performed using the BOSCH filter-type smokemeter.

The filter-type smokemeter consists of the following:

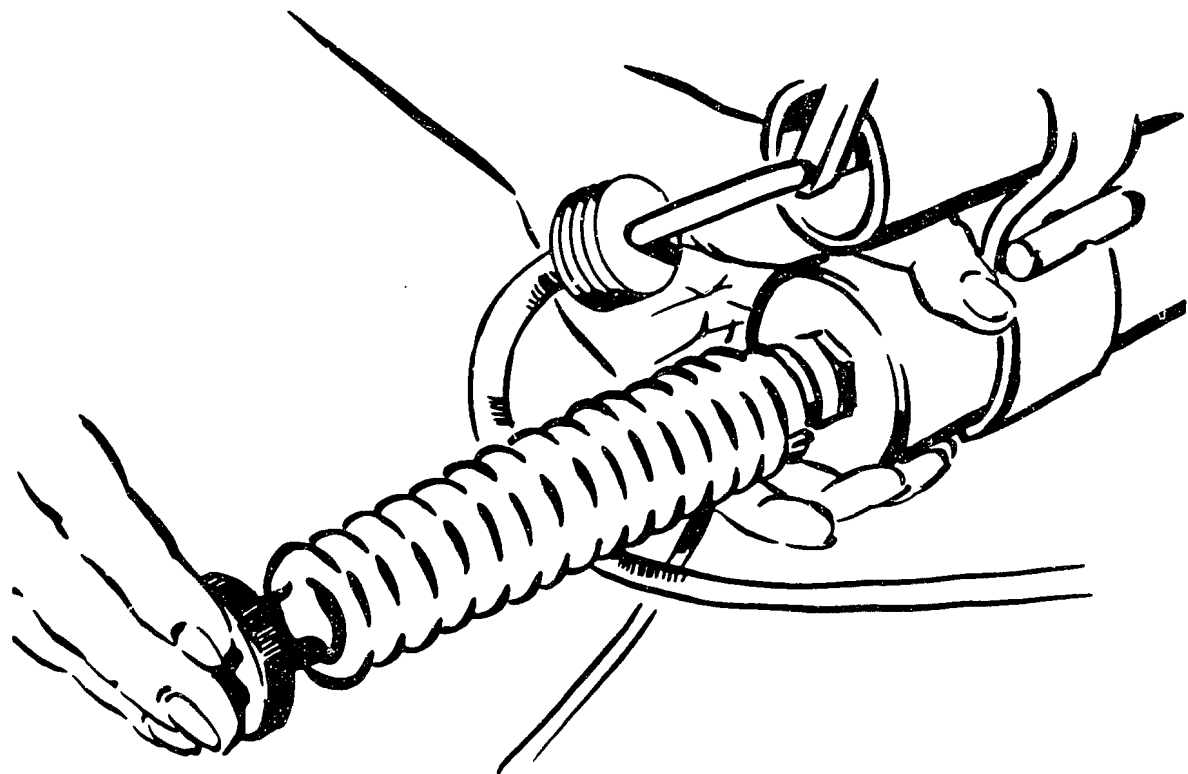
- * Accessory set with sampling pump 0 681 169 038
or 0 681 169 058
- * Evaluating unit 0 684 102 050

Insert filter in sampling pump
(in the case of filter-type smokemeter 0 681 169 038).



Use appropriate clamp to attach respective sampling pump to exhaust pipe.

Insert sample pickup as far as possible into exhaust pipe and secure it in position.



460 /0050

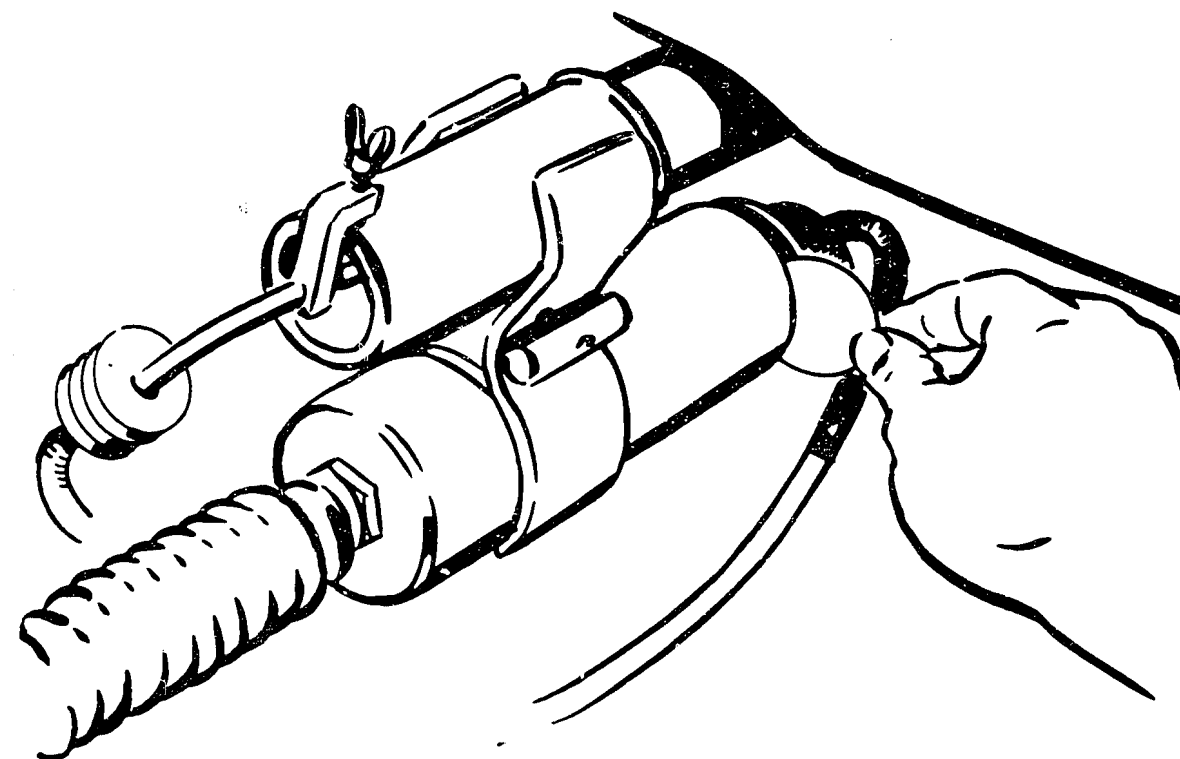
Measurement in accordance with steady-state method.

Prime sampling pump by pushing in black pushbutton. Take rubber ball on triggering hose into passenger compartment.

Testing can either be performed on "rollers" (chassis dynamometer) or on the road (hill). Chassis-dynamometer testing should always be given preference.

Select gear in which a speed of approximately 40 km/h is reached in full-load position of accelerator pedal.

Load engine such that a speed of approx. 25 km/h is reached in same accelerator-pedal position.



460 /0051

Maintain this load condition for 5 seconds. Then trigger sampling pump by squeezing rubber ball.

Switch off engine.

C A U T I O N !

When performing following operation, ensure that exhaust pipe has been heated up by running engine.

Remove filter from sampling pump.

Test prerequisite:

With a view to handling and manual operation, we recommend that outdoor measurements should not be performed either when it is raining or when the air temperature is below 0° C.

The engine must be at operating temperature before measurements can be performed (temperature of cooling water at least 60° C).

CAUTION !

When performing subsequent operations, make sure that exhaust pipe is heated by running engine.

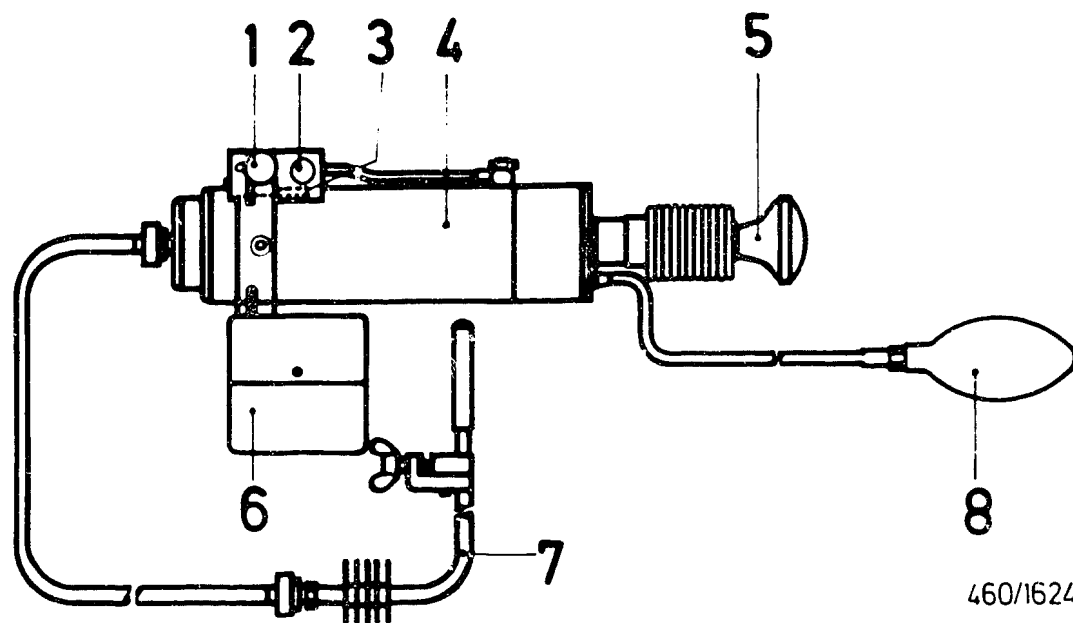
Test sequence:

In order to clean the exhaust system, run the engine up to its breakaway speed at least three times in quick succession immediately prior to measurement.

Squeeze rubber ball to trigger intake stroke of sampling pump approximately 1 second prior to 4th acceleration cycle.

Then depress accelerator pedal quickly as far as it will go until maximum engine speed is attained and governor of fuel-injection pump effects regulation.

Release accelerator pedal immediately after reaching breakaway speed (idle position)



460/1624

- 1 = Rotary knob for paper transport
- 2 = Pushbutton for compressed-air actuation
- 3 = Compressed-air connection
- 4 = Sampling pump
- 5 = Manual actuation mechanism
- 6 = Magazine for roll of filter paper
- 7 = Sample pickup
- 8 = Rubber ball

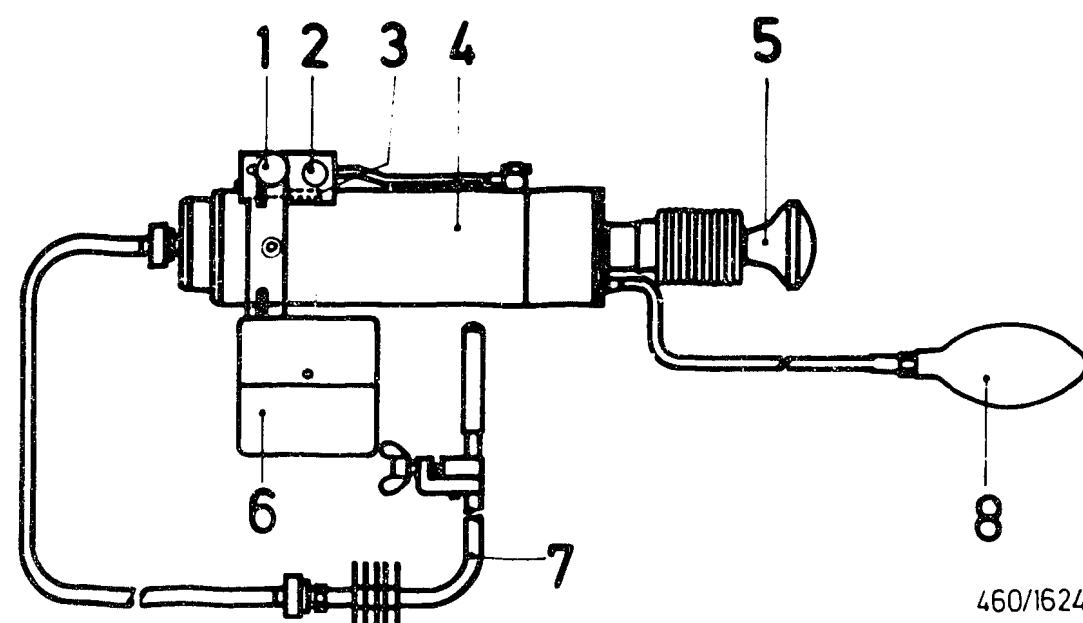
Measurement in accordance with acceleration method in conjunction with filter-type smokemeter 0 681 169 058.

Use of sampling pump:

The plunger of the sampling pump can be set to its operating position either by hand or using compressed air.

A corresponding connection (3) and a pushbutton (1) are provided for compressed-air actuation.

Prime sampling pump.



- 1 = Rotary knob for paper transport
- 2 = Pushbutton for compressed-air actuation
- 3 = Compressed-air connection
- 4 = Sampling pump
- 5 = Manual actuation mechanism
- 6 = Magazine for roll of filter paper
- 7 = Sample pickup
- 8 = Rubber ball

Actuation of the pushbutton (2) moves the plunger back into its operating position (when testing with compressed-air supply).

Keep button depressed until engagement takes place.

Continue transportation of filter paper by one detent position by turning rotary knob (1)
(filter paper is released and tensioned automatically).

Repeat measurement three times.

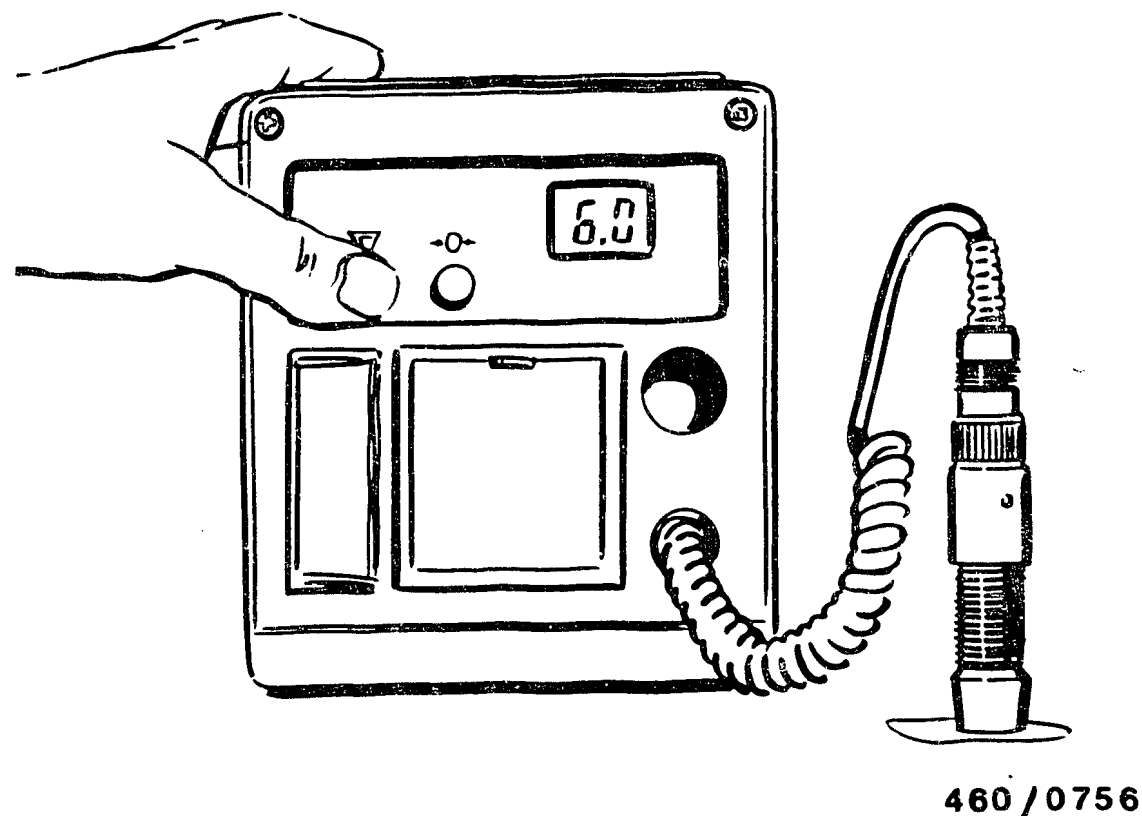
Move plunger to operating position and tear off soot-covered measurement strip.

When performing acceleration measurements, individual measurements are to be taken until three consecutive blackening rates do not differ by more than 1 Bacharach unit.

Note:

If engines feature connectable and disconnectable pressure-charging, the entire measurement series is to be performed with pressure-charging.

460/1624



Measurement

Place filter from sampling pump with soot side upwards on 3 new filters positioned one above the other.

Press measuring head vertically on to black surface of filter.
Simultaneously press button "C" until measured blackening rate is displayed.

Note:

Measuring head must be pressed on firmly both when performing zero balancing and when taking measurements (even slight tilting can result in measurement errors).

Compare blackening rate determined to evaluation sheet paying attention to kW (bhp) data given by vehicle manufacturer.

Filter evaluation

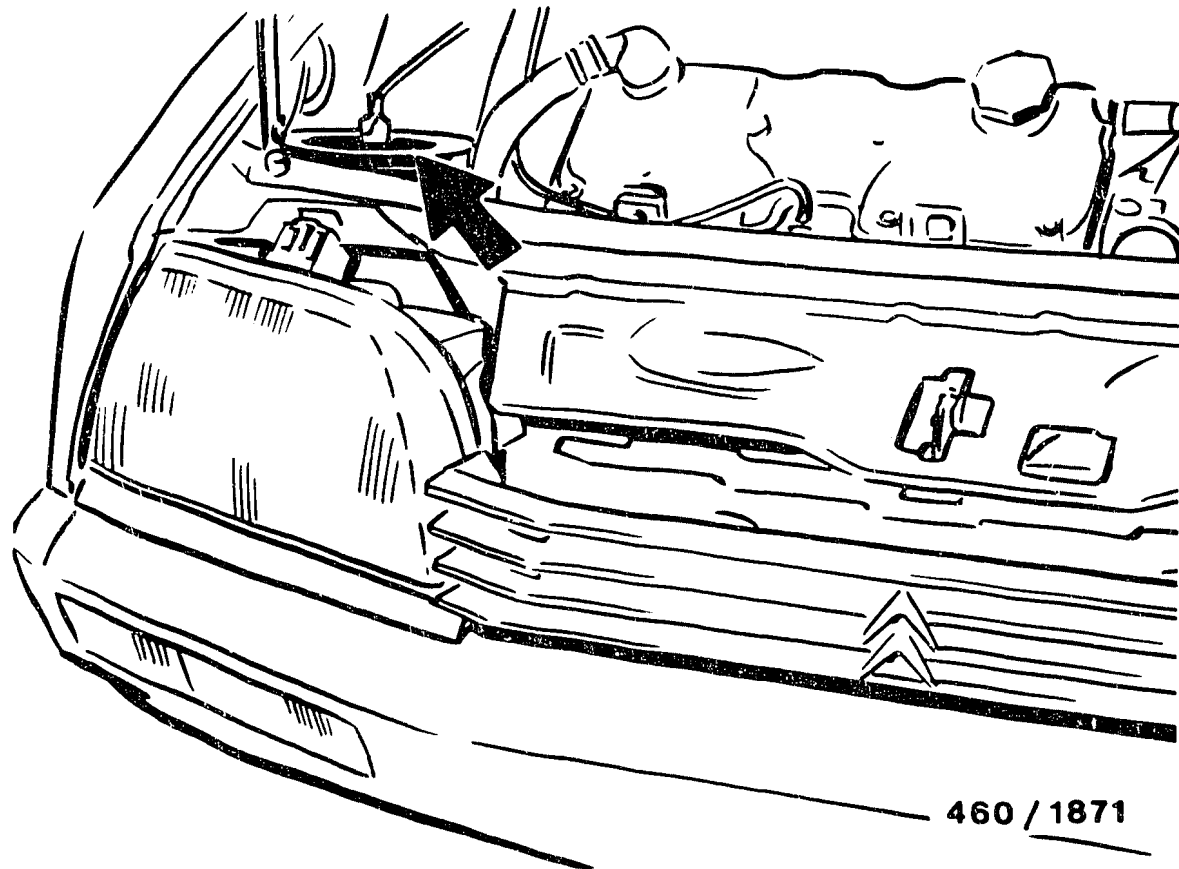
Perform zero balancing on evaluating unit.

Zero balancing must be performed:

- * prior to each series of measurements
- * whenever ambient conditions change
- * whenever the lens of the photocell adapter has been cleaned

Press measuring head of photocell adapter firmly onto 5 clean, white filters positioned one on top of the other.

Press button "0" until 0.0 is displayed
Release button "0".



Test air filter (picture, arrow)

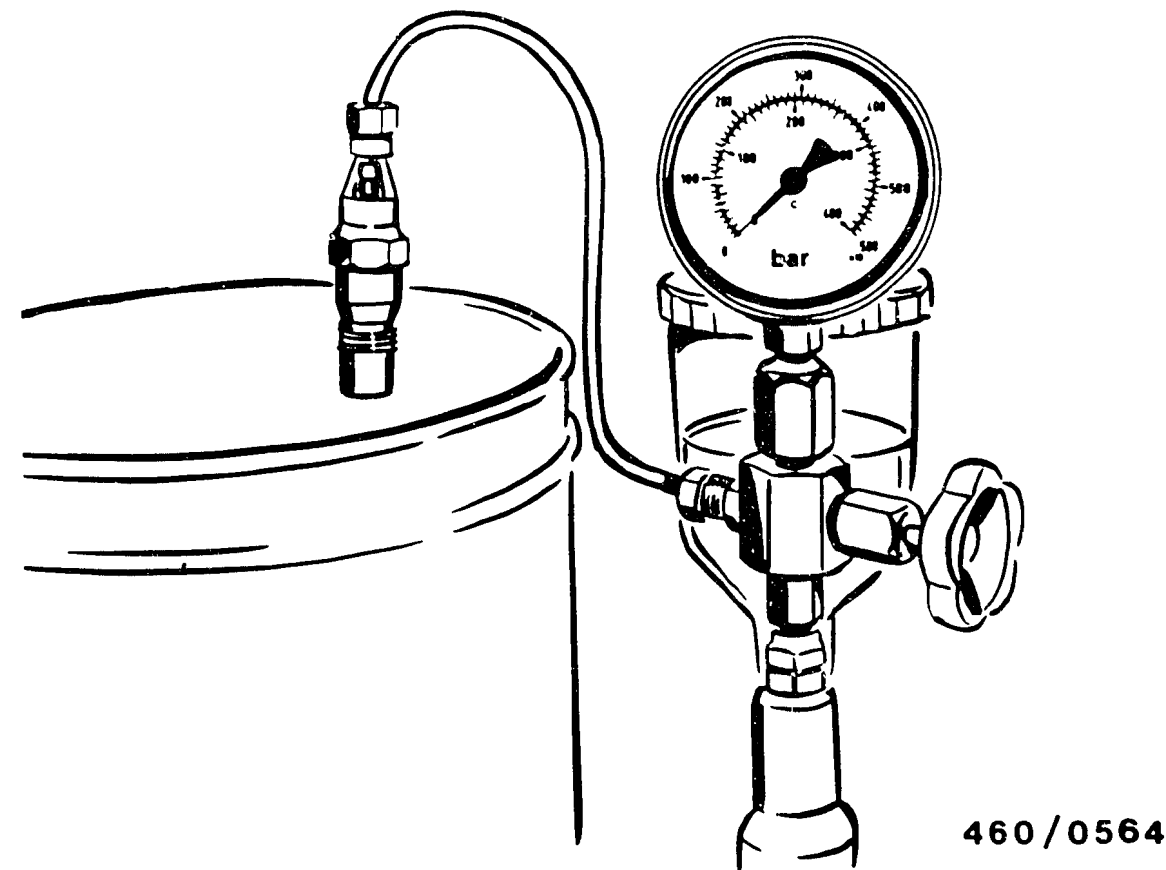
Remove air filter and subject it to a visual examination.

Test criteria for air filter:

- * Dust-covered air filter
(test by knocking it out)
- * Oily air filter
- * Solid matter in air filter, e.g. leaves

In case of doubt use new filter element.

Return to trouble-shooting chart



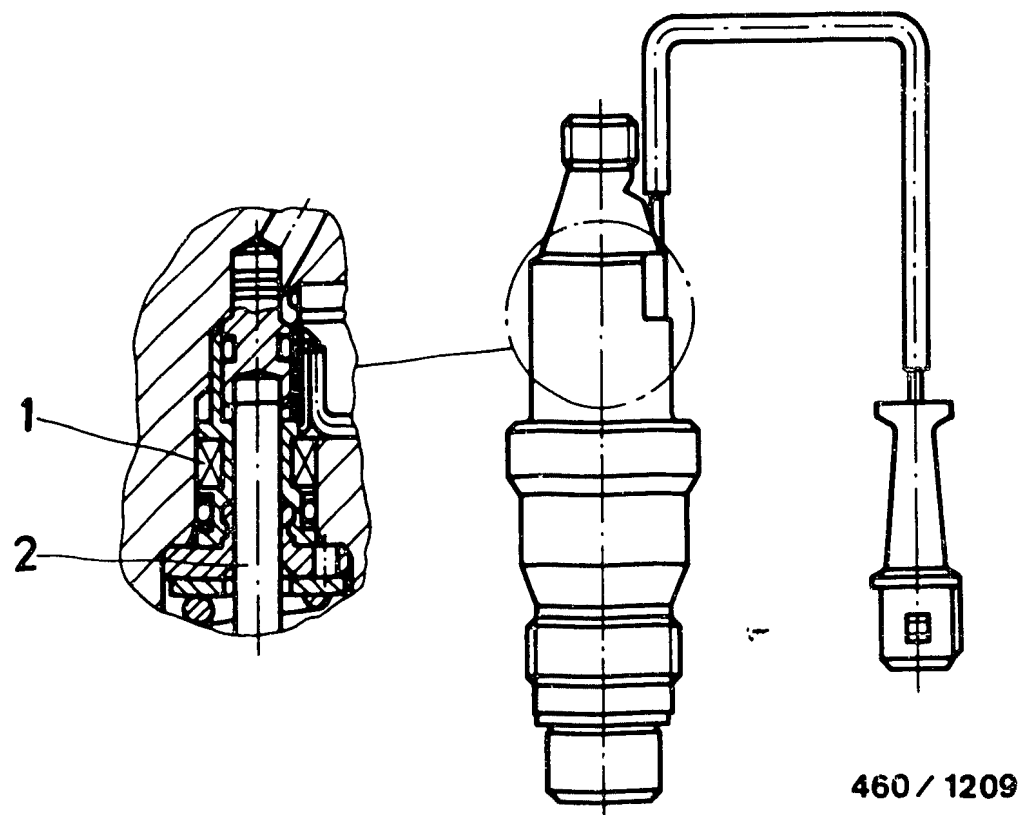
TESTING INJECTION NOZZLES

Remove injection nozzles.

Testing is performed using the nozzle tester EFEP 60 H, 0 681 200 502.

Attach injection nozzle with nozzle-holder assembly to nozzle tester.

To ensure that the nozzle is not subjected to torsion, actuate hand lever of nozzle tester firmly several times with pressure gauge disconnected (approx. 4 - 6 downward movements every second).



1 = Needle-motion sensor
2 = Spindle

Nozzle-holder assembly with inductive needle-motion sensor (cylinder no. 2)

After-Sales Service Centers may only correct the opening pressure.

Use is to be made for this purpose of special shims (larger diameter of central bore).

Nozzle-holder assemblies are to be renewed as a complete assembly if parts of the nozzle are damaged.

Note :

Replacing nozzle components alters the signal voltage of the sensor coil and results in incorrect evaluation by the start-of-injection control unit.

Note

When testing injection nozzles, ensure that the jet of fuel does not get on to the hands, since the fuel gets into the skin as a result of the high pressure and can cause blood poisoning.

Use is to be made for test purposes of pure calibrating oil as per ISO 4113 or clean diesel fuel.

Test criteria: * opening pressure
* leakage
* chatter
* spray pattern

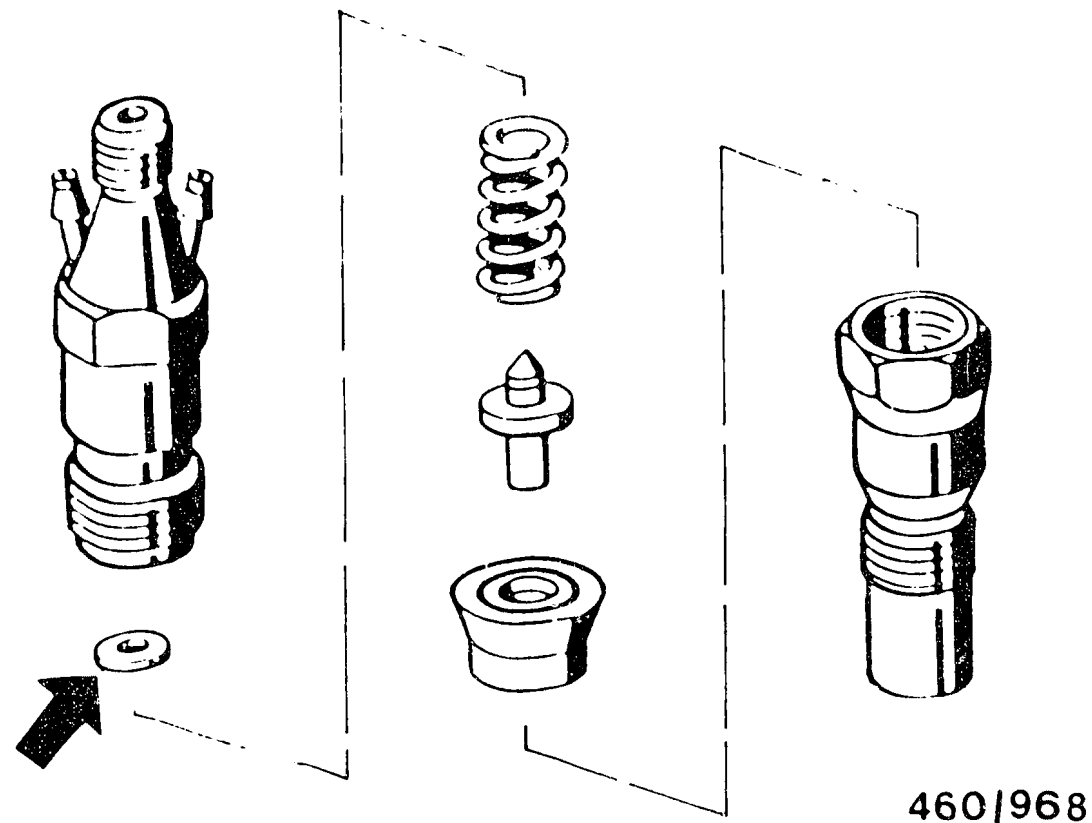
Test opening pressure.

Open shutoff valve on pressure gauge by approx. 1/4 of a turn.

Slowly press down hand lever of nozzle tester (pressure increase on pressure gauge).

Note pressure at which pointer of pressure gauge comes to a halt (no nozzle chatter) or at which the pressure suddenly drops off (nozzle chatters).

The maximum pressure attained in this process is the opening pressure.



In the event of deviations from the set value, correct nozzle opening pressure by means of shims behind pressure spring (arrow).

Refer to brief instructions for set value.

Thicker shims = higher nozzle opening pressure
Thinner shims = lower nozzle opening pressure

A \pm 0.05 mm change in spring travel alters the nozzle opening pressure by approximately 5.0 bar.

Leak test

Open shutoff valve on pressure gauge by approx. 1/4 of a turn.

Dry off lower part of nozzles and nozzle-holder assembly (blow dry with air).

Slowly press down hand lever until pressure gauge reading is 20 bar less than the opening pressure read off previously.

The nozzle is not leaking if no droplet drips off from the mouth of the nozzle within 10 seconds.

If a droplet drips off, the nozzle-and-holder assembly is to be disassembled and cleaned.

If there is still a leak, the nozzle is to be renewed.

Nozzle components are not to be reworked.

Note:

Scoring on the holder and intermediate disc can be reworked employing the necessary caution (except during warranty period).

Chatter and spray test

This involves pintle nozzles with throttling effect such as are installed in all types of engine.

These nozzles feature a special bottom shape and an additional hole through which the pre-spray emerges.

Chatter test:

This type of nozzle chatters very quietly on account of its special design characteristics.

With such a nozzle, a chatter test is only possible with between 1 and 2 downward movements of the hand lever per second.

The chatter stops if the test speed is increased.

The calibrating oil then emerges from the nozzle with a hissing noise.

The nozzle only chatters with a loud whistling tone if the hand lever is moved rapidly and jerkily (between 4 and 6 downward movements per second).

Spray pattern: (applies only to new nozzles)

Given a low test speed, the majority of the quantity delivered must be thoroughly atomized and emerge through the pre-spray hole on the side without pronounced streaking.

Assessment of the main spray is only possible if the hand lever is moved quickly (between approx. 4 and 6 downward movements per second).

The spray must be continuous and thoroughly atomized.

Chatter test, assessment of spray pattern

General:

As regards the assessment of nozzles, a distinction is to be made between new and used nozzles.

Switch off pressure gauge.

New nozzles:

The chatter test makes it possible to listen to whether the needle valve is moving freely in the nozzle body.

If the nozzle doesn't chatter despite cleaning, it is to be replaced with a new one.

The spray pattern has no significance for the chatter test.

A spray pattern corresponding to specifications is generally only obtained with new nozzles.

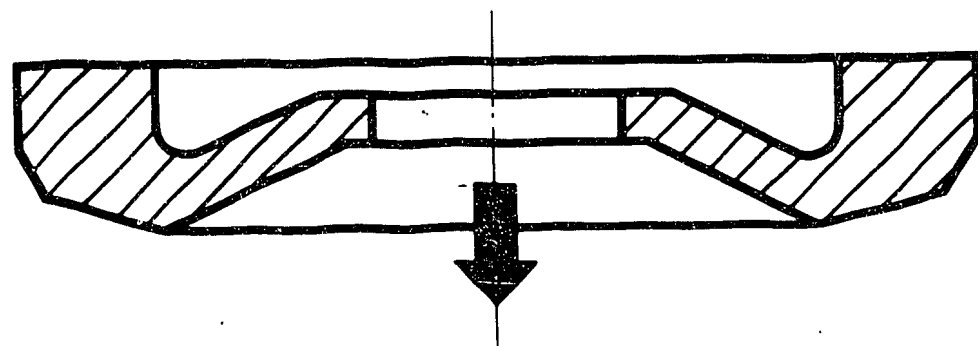
Used nozzles:

The chatter behavior of the nozzles is impaired by wear in the seat area.

When the lever is actuated rapidly, the nozzle must be heard to chatter and/or provide a thoroughly atomized spray.

With used nozzles, the spray pattern may deviate from the ideal pattern of a new nozzle.

The spray pattern of such nozzles can however be noticeably improved by means of suitable cleaning measures.



460/0609

Install injection nozzles

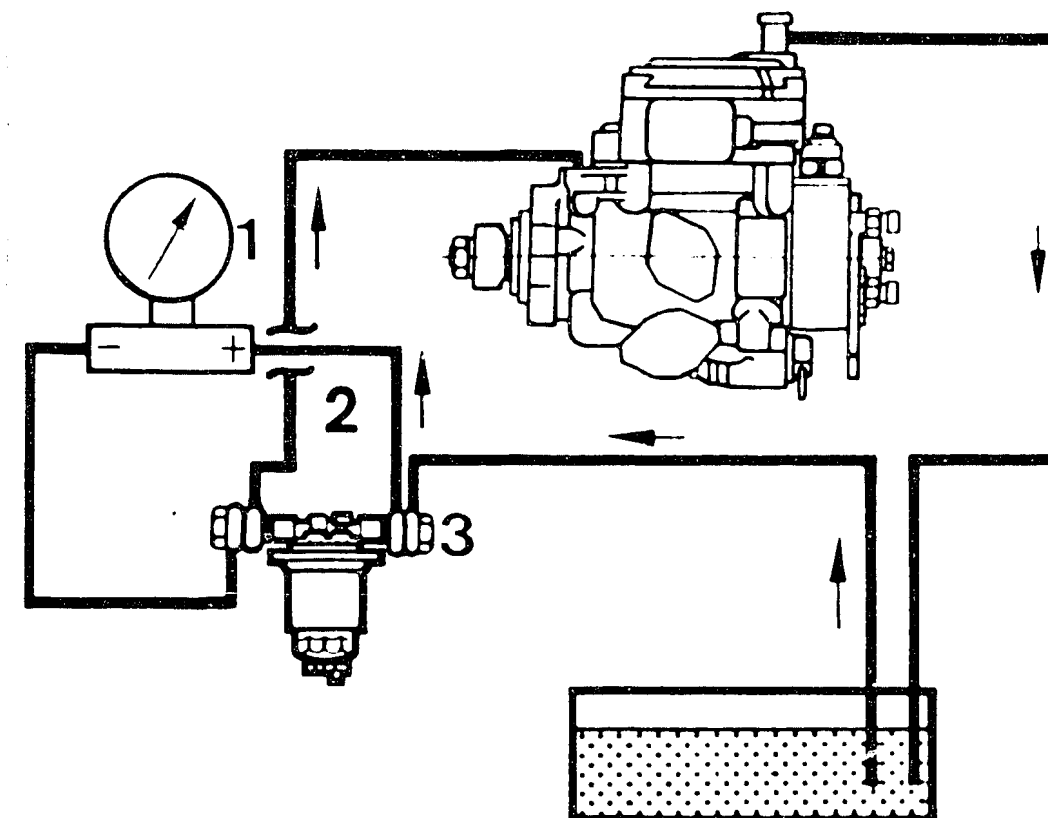
Before installing injection nozzles, fit a new thermal-insulation washer in the correct position in the cylinder head as a shield and to provide tolerance equalization (sealing cone 150° in direction of arrow).

Then screw nozzle-holder assembly into cylinder head (pay attention to tightening torque; refer to brief instructions).

Note:

The needle valve may stick if the tightening torque is exceeded.
Tighten union nuts of fuel-injection tubing to 25 Nm.

Return to trouble-shooting chart B04

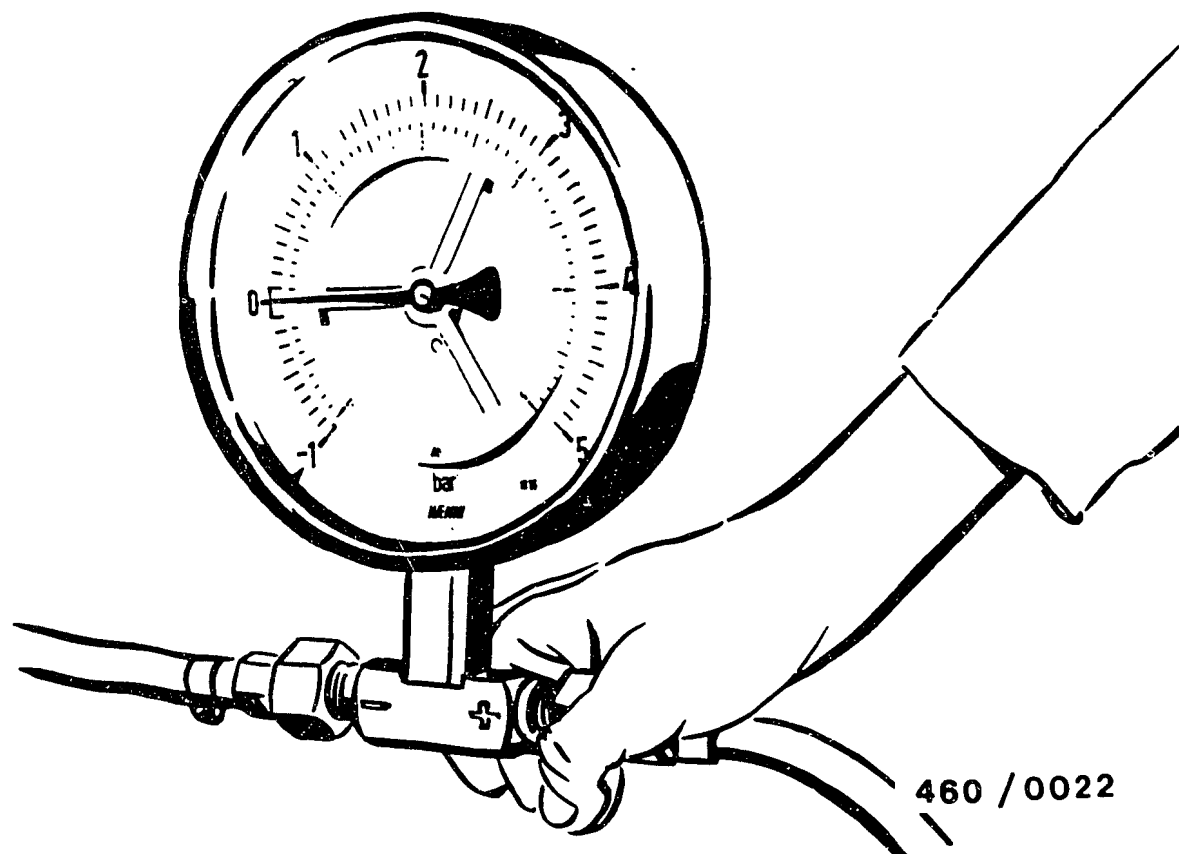


460/1566

- 1 = Differential-pressure device
- 2 = Filter outlet
(employ inlet union and overlength inlet-union screw 2 443 456 020)
- 3 = Filter inlet
(employ inlet union and overlength inlet-union screw 2 443 456 020)

TESTING FUEL FILTER (DIFFERENTIAL PRESSURE TEST)

Connect differential-pressure device to fuel filter by way of corresponding connection parts.



Connect side of differential-pressure device marked (+) to fuel-filter inlet.

Attach (-) connection of pressure gauge to filter outlet.

Pay attention to connection diagram.

Let engine run until all air has been expelled from the fuel system.

Move accelerator pedal for approximately 1 second from idle stop to maximum-speed stop.

Release accelerator pedal and read off differential pressure on pressure gauge.

The differential pressure may be a maximum of 0.3 bar.

The filter is to be replaced if this value is exceeded.

Remove test connections.

Bleed fuel system if appropriate.

Return to trouble-shooting chart

TESTING TIMING DEVICE/START-OF-DELIVERY SOLENOID VALVE

Timing device

Prerequisite:

- Solenoid valve actuator O.K.
- Engine cold < 30° C
- Detach needle-motion-sensor connection.

Functional test:

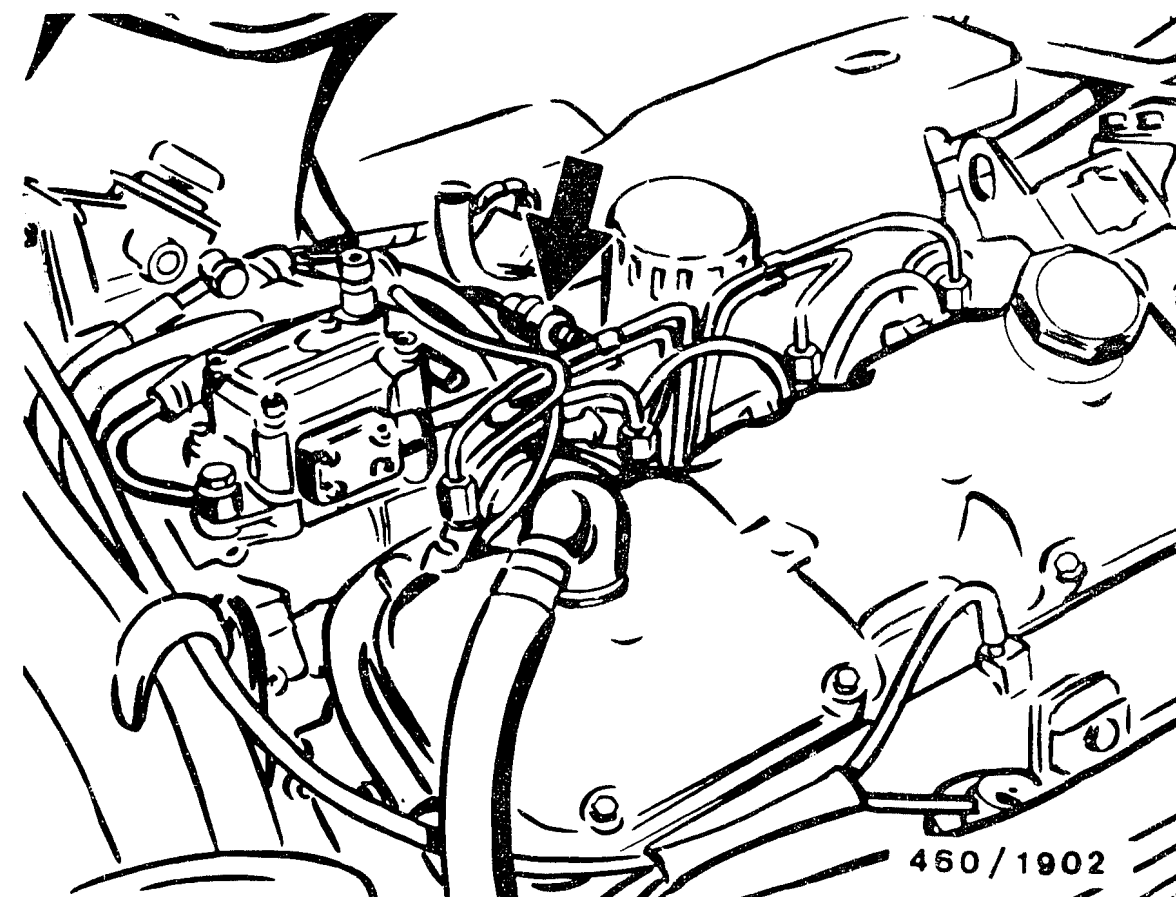
Allow engine to idle.

Detach multiple butt connector from solenoid valve.

Engine is heard to run harder as a result of advance .

If engine does n o t run harder, remove fuel-injection pump (cause e.g. solenoid valve or timing device sticking).

Return to trouble-shooting chart B06



MEASURING ENGINE COMPRESSION AND COMPRESSION LOSS

Measure engine compression

Provide a new chart for compression tracer.

Attach high-pressure hose to tracer.

Switch off engine.

To prevent fuel injection, 7-pole connection (picture, arrow) is to be disconnected (the self-diagnosis fault memory is to be cleared after performing test).

Unscrew sheathed-element glow plugs and make use of suitable connecting nipple for compression gauge.

Crank engine several times with starting motor to remove loose residue from compression chamber.

Screw in connecting nipple.

Attach high-pressure hose of compression gauge to connecting nipple.

When performing subsequent operation, pay particular attention to first compression stroke.

Actuate starting motor until no further increase in pressure can be established on the compression tracer.

Vent compression tracer by pressing on vent valve.

This causes the pointer to return to the initial position.

Move chart to next position.

Attach connecting nipple to following cylinders and repeat measurement.

Compression:
refer to brief instructions for set values

Permissible cylinder deviation:
refer to brief instructions for set values

Evaluation of chart

Normal increase in pressure:

The first compression stroke reveals the highest increase in pressure if the piston rings and valves are in perfect condition.

The compression builds up to the maximum pressure during the course of the subsequent compression strokes.

Gradual increase in pressure:

If the compression only increases gradually from the outset with each piston stroke, this is an indication of burnt valve seats or inadequate valve guidance.

Low maximum pressure:

If the maximum compression obtained on all cylinders is too low, this is an indication of defective pistons, piston rings or valves.

Inadequate compression on two adjacent cylinders is an indication of cylinder-head-gasket leakage.

Differing compression

If one cylinder reveals a considerably lower compression, the following procedure is to be employed:

Pour in between 2 and 3 cm³ of engine oil through opening in sheathed-element glow plug or nozzle-holder assembly and briefly actuate starting motor.

Repeat tests and compare charts.

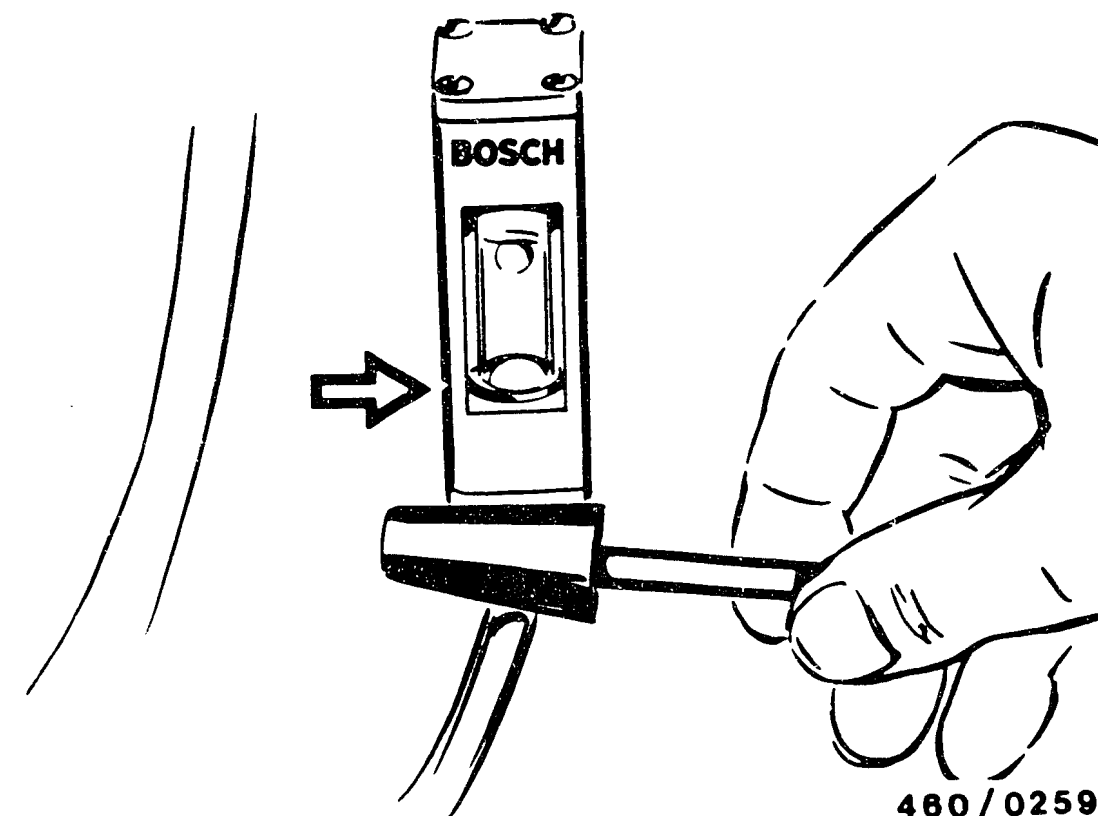
If the compression obtained in the second test is clearly higher, then the piston rings or cylinders are worn.

If the result is the same, damaged valves are to blame.

Uniform compression

Uniform compression is of major significance as regards smooth engine running.

The sole aim should therefore not be to attain the highest possible compression.



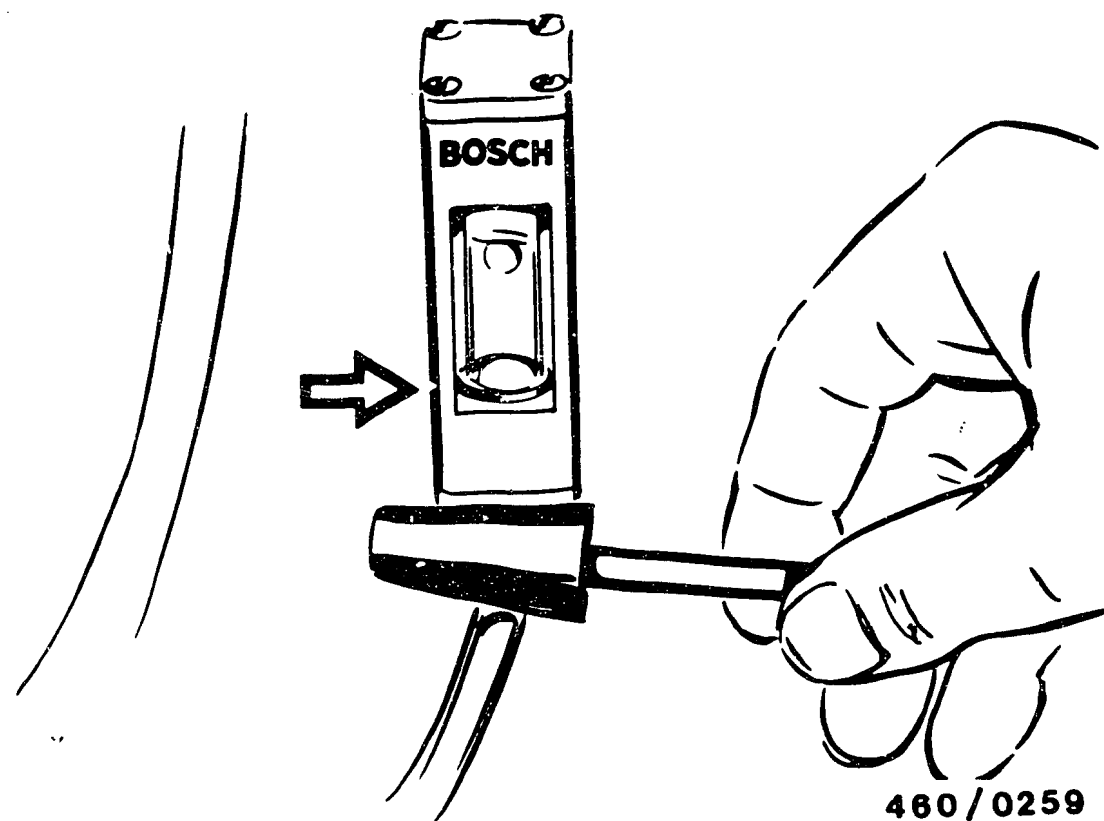
Measure compression loss of engine:

Use is to be made for test purposes of the BOSCH compression-loss tester 0 681 001 901 (EFAW 210 A).

When performing tests, the respective cylinder must be in the TDC position (TDC = top dead center) of the compression stroke.

For adjusting this point, use is to be made of the dead-center detector 1 688 132 025 (contained in accessory set for compression-loss tester).

Carry out test with engine at operating temperature (water temperature approx. 80° C).



TDC adjustment

Remove sheathed-element glow plug of cylinder no. 1.

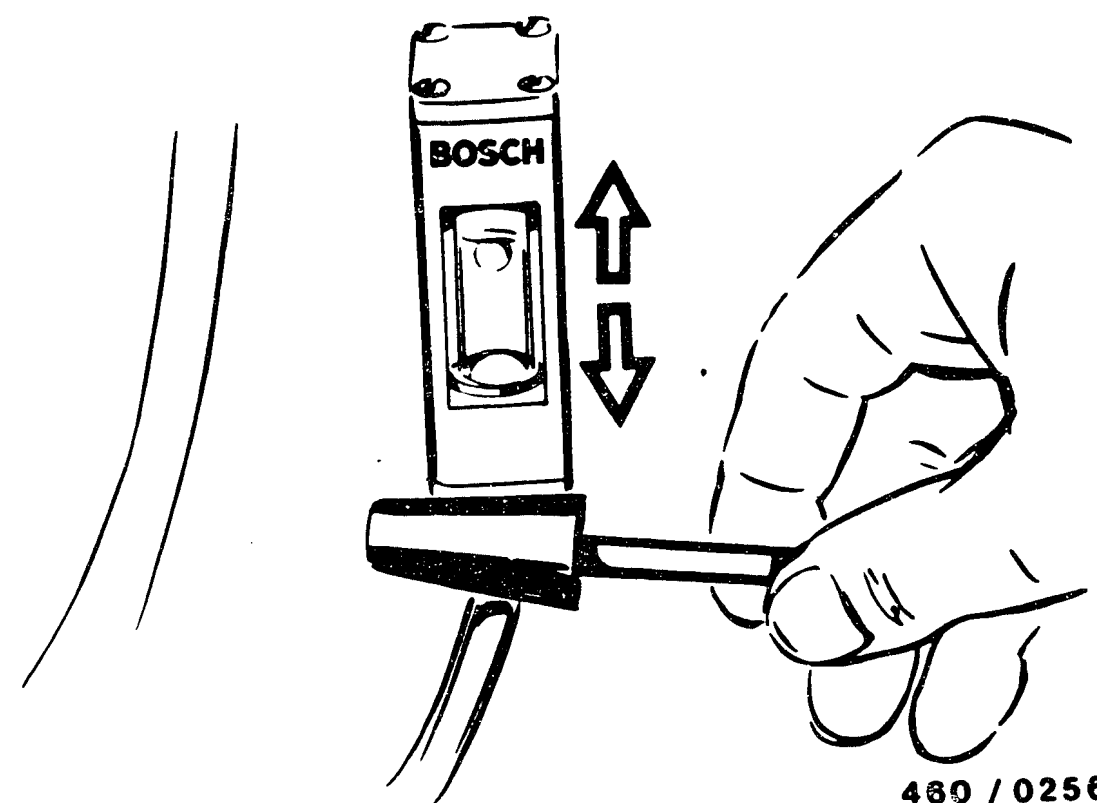
Insert rubber plug of dead-center detector in hole for sheathed-element glow plug.

Use magnet to position glass cylinder as vertically as possible in engine compartment.

The plunger must be readily visible.

Slowly crank engine by hand in direction of rotation (if necessary, engage gear and move vehicle).

460 / 0259

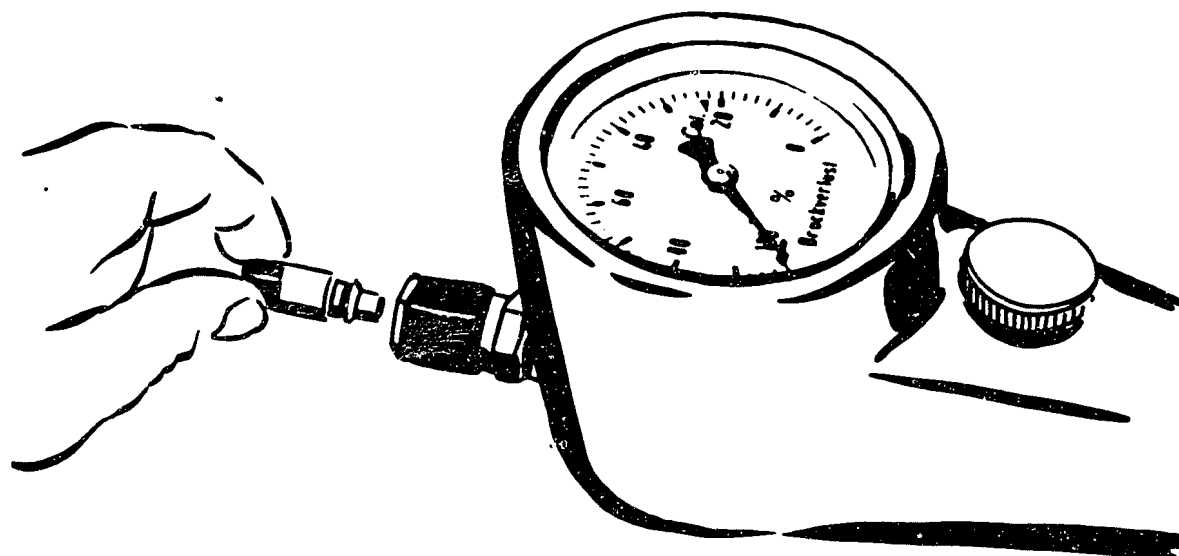


The compression stroke causes the plunger of the dead-center detector to move upwards.

The plunger immediately slips down when the top dead center point is exceeded.

Determine dead center by carefully turning engine back and forth.

460 / 0258



460/0057

Compression-loss measurement

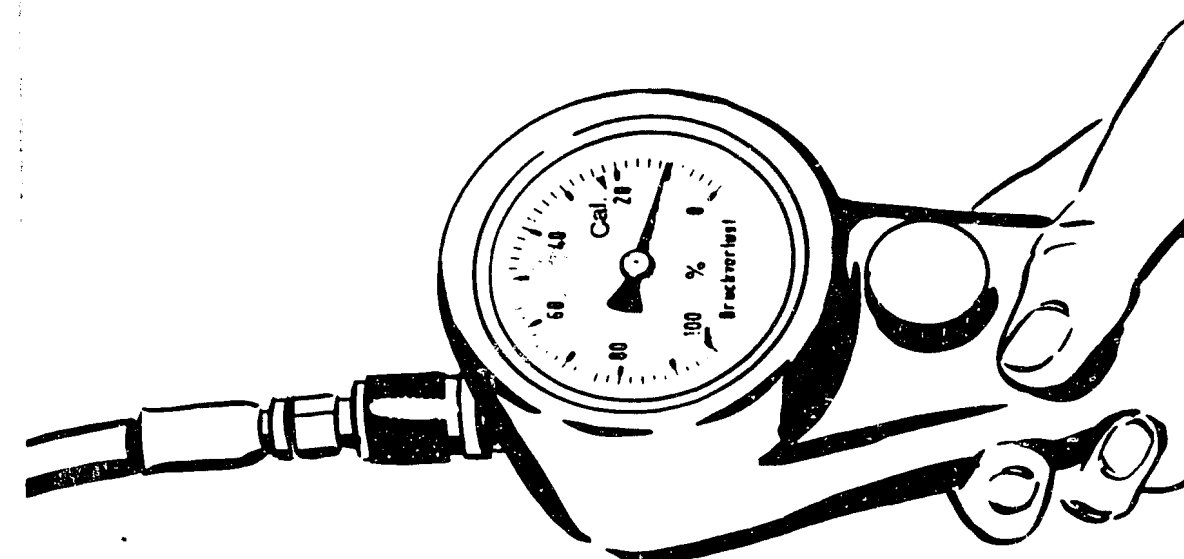
Connect tester to compressed-air network.

Connect up calibrating nozzle 1 680 363 036.

Set compression loss of 23 ± 1 % ("Cal." mark) on knurled screw of pressure regulating valve.

Indicator of measuring instrument may deviate by plus/minus one division from zero.

Otherwise the tester is defective.



460/0058

Screw in fitting and attach test hose.

Engage gear and pull on hand brake.

Connect test hose to tester.

Read off compression loss in % on instrument.

Note:

Before performing measurement on next cylinder, briefly start engine with starting motor and without preheating, so as to enable the oil film to re-form.

Evaluation of test

The compression-loss reading should not exceed 25 %.

Differences of 10 % between the individual cylinders have no significance.

Major leaks can be localized as the air emerging makes a noise.

Listen at following locations:

Noise locations	Possible cause of fault
Intake manifold (Remove air filter)	Intake valve
Exhaust manifold	Exhaust valve
Engine-oil filler neck	Pistons, piston rings
Cooling-water filler neck (air bubbles)	Cylinder head gasket

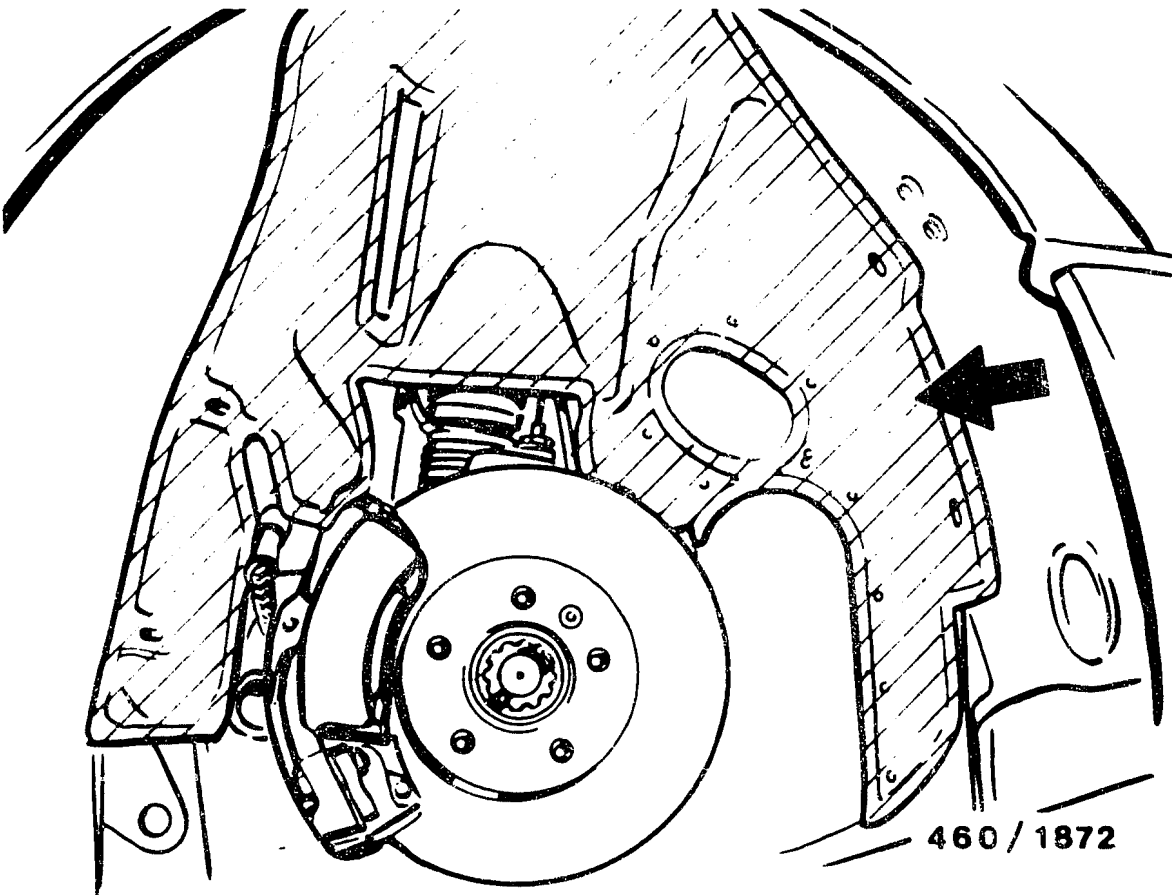
Pour between 2 and 3 cm ³ of engine oil into the cylinders so as to make it easier to localize the cause of the fault.

Repeat test.

If the test shows the compression loss to be considerably less, the fault can be attributed to the piston or piston rings.

Higher compression losses than those encountered after the running-in period are possible with new engines which have still not been run in (less than 5 000 km).

Return to trouble-shooting chart B02



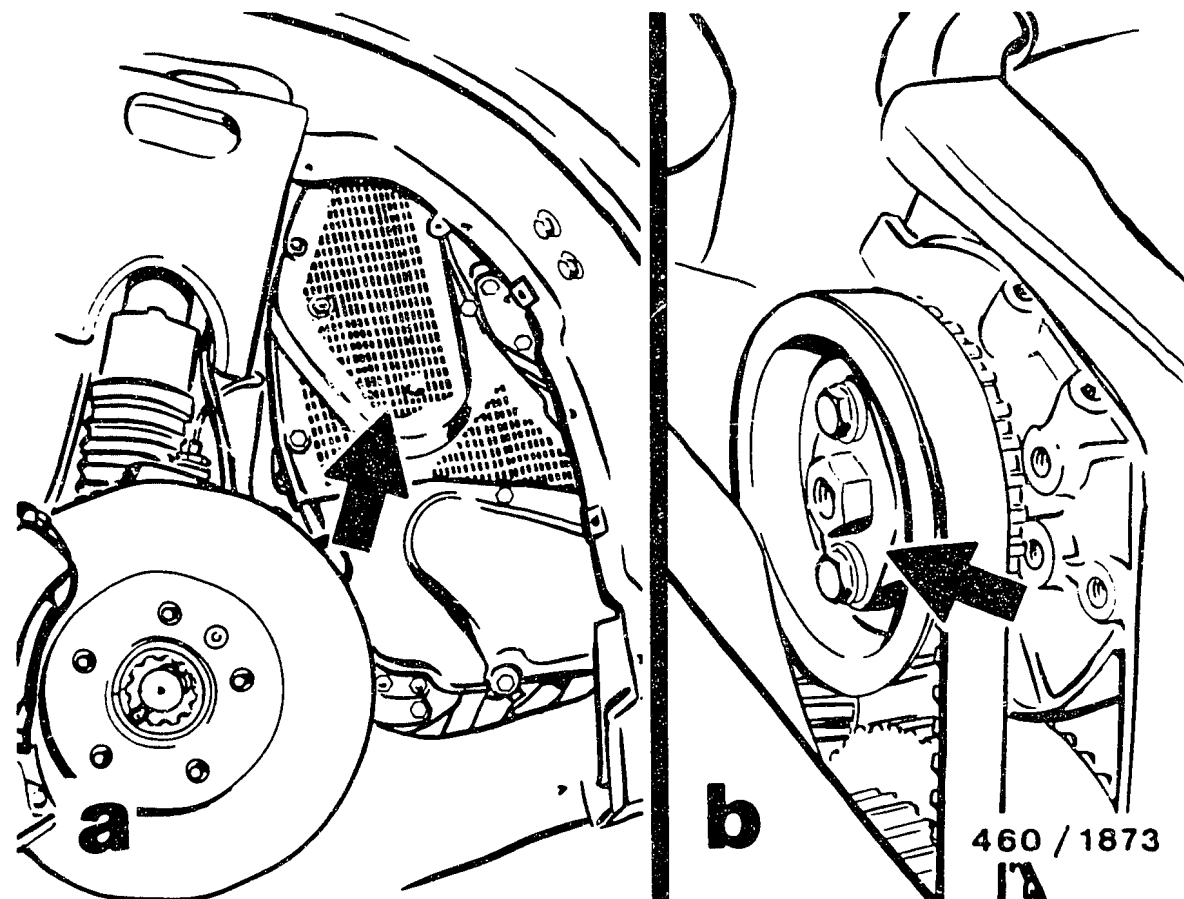
REMOVING FUEL-INJECTION PUMP

Detach ground cable from battery.

Jack up vehicle at front (caution! only apply jack at envisaged locations) and support on right-hand side with chock.

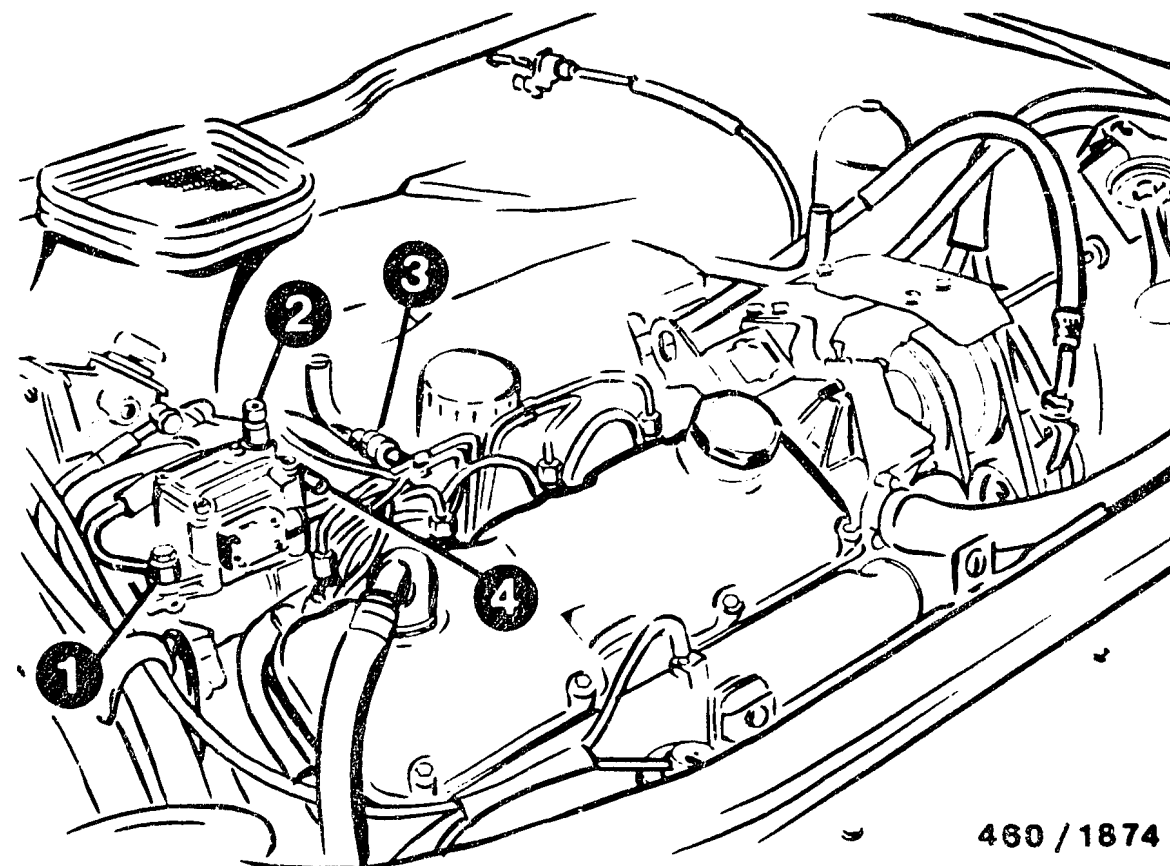
Remove wheel.

Remove trim in wheel housing.
(picture, arrow).



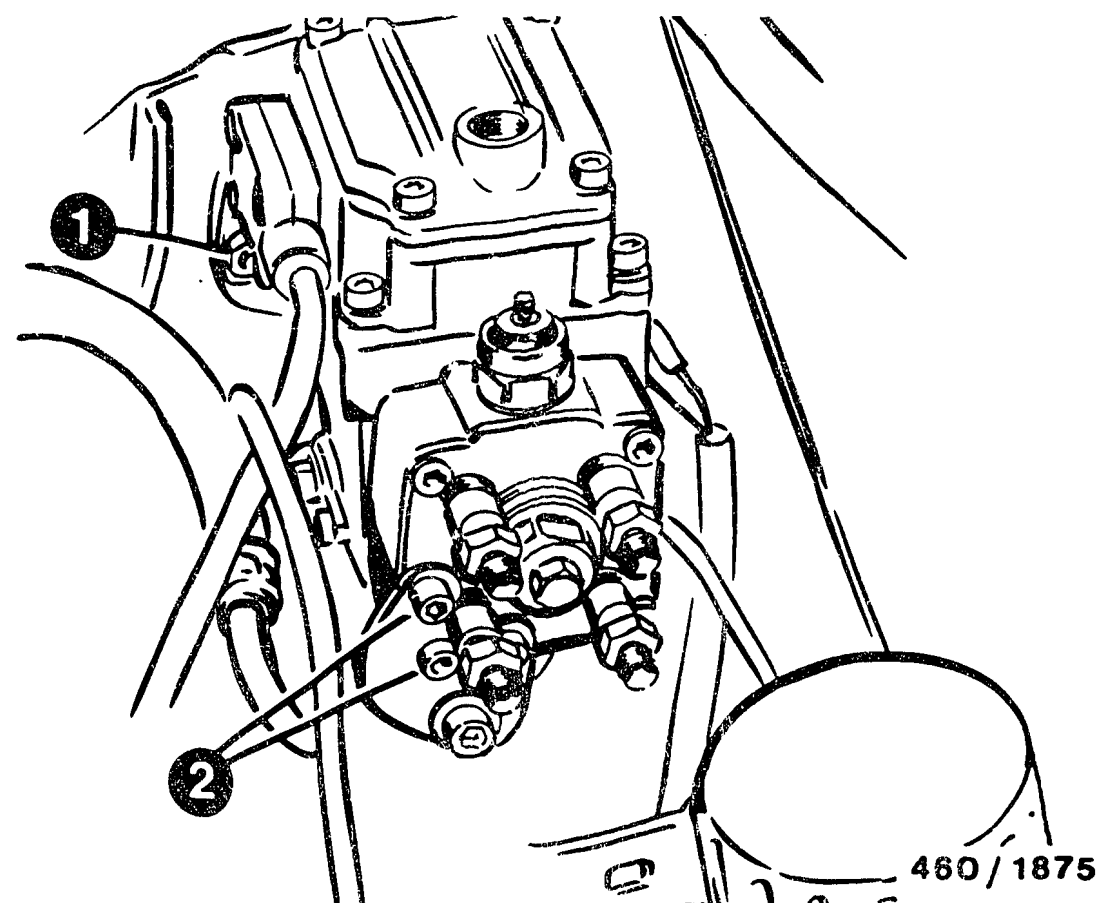
Transmission in neutral.
Remove toothed belt covers
(picture a, arrow).

Detach belt tensioner from toothed belt of
fuel-injection-pump drive. Remove toothed
belt. Use extractor (Citroen, 6028-T from tool kit
OUT 206 028 T) to remove toothed-belt sprocket from
shaft stub of fuel-injection pump (picture b, arrow).



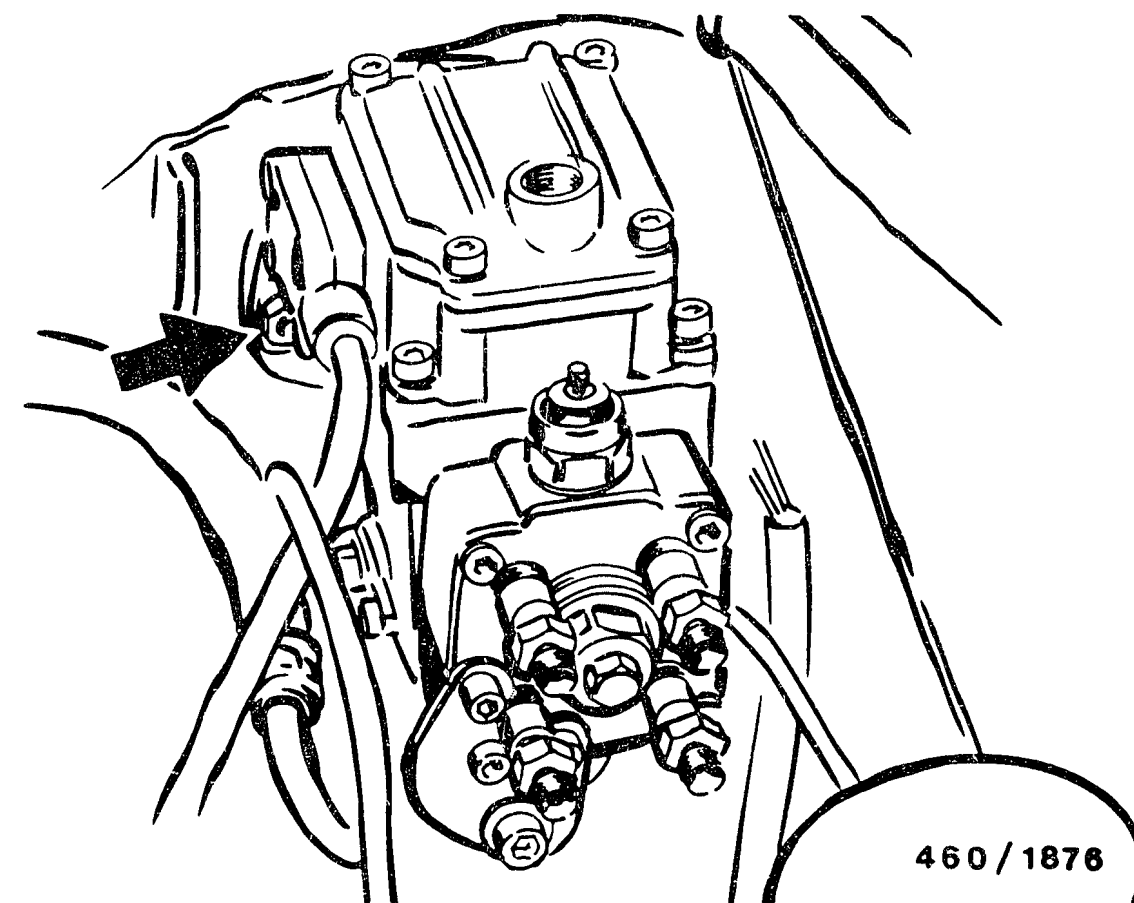
- 1 = Fuel supply line
- 2 = Fuel return line
- 3 = 7-pole plug connection
- 4 = Electric shutoff device

Remove high-pressure lines.
Detach fuel supply line and fuel return line.
Detach plug connection for start-of-delivery
solenoid valve, 7-pole plug connection and
connecting lead to electric shutoff device.



- 1 = Fastening nuts for fuel-injection-pump flange (2)
 2 = Fastening screws, support plate

Remove fastening screws at support plate.
 Unscrew fastening nuts (2) at fuel-injection-pump flange.

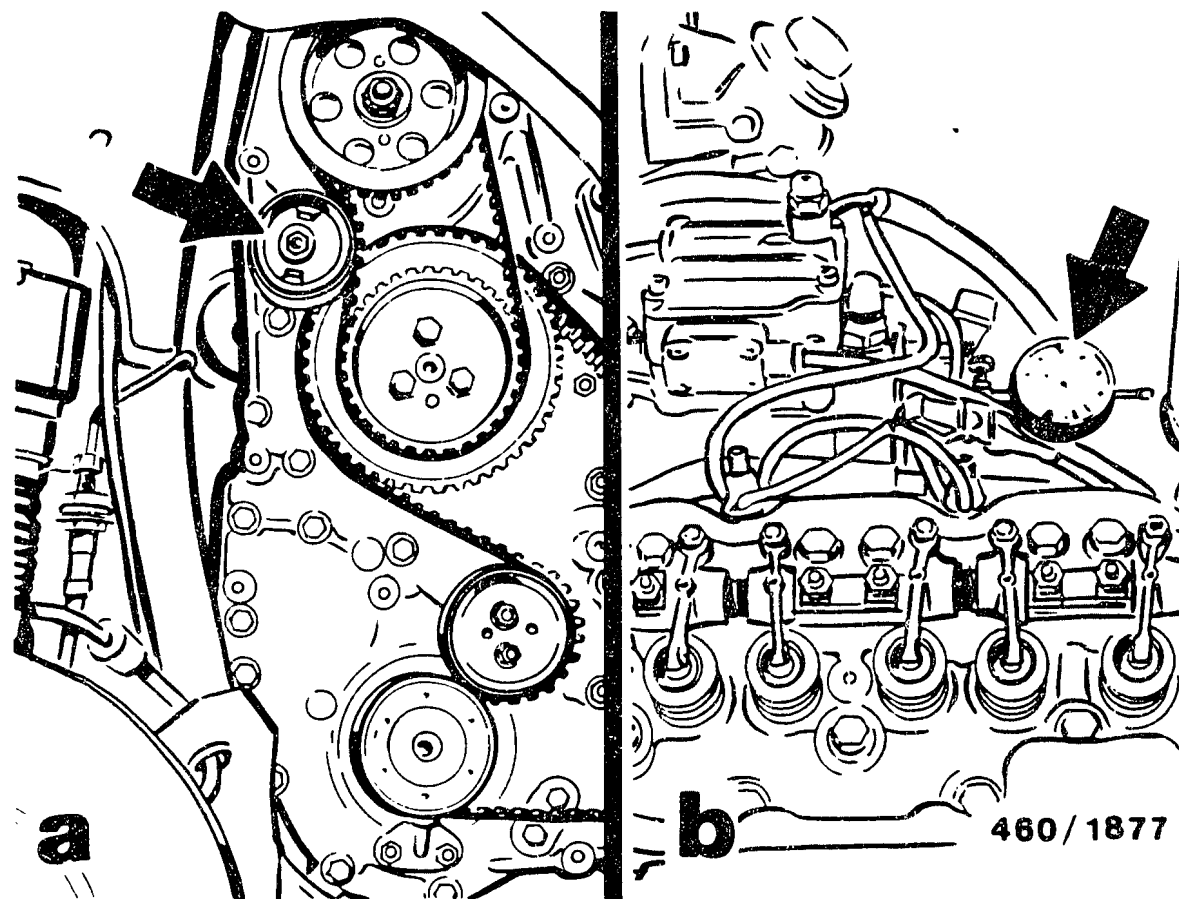


INSTALLING FUEL-INJECTION PUMP

Position keyway of shaft stub of fuel-injection pump such that it faces upwards.

Fit fuel-injection pump centrally in slots at fuel-injection-pump flange (picture, arrow).

Hand-tighten fastening nuts at fuel-injection-pump flange and fastening screws at support plate.

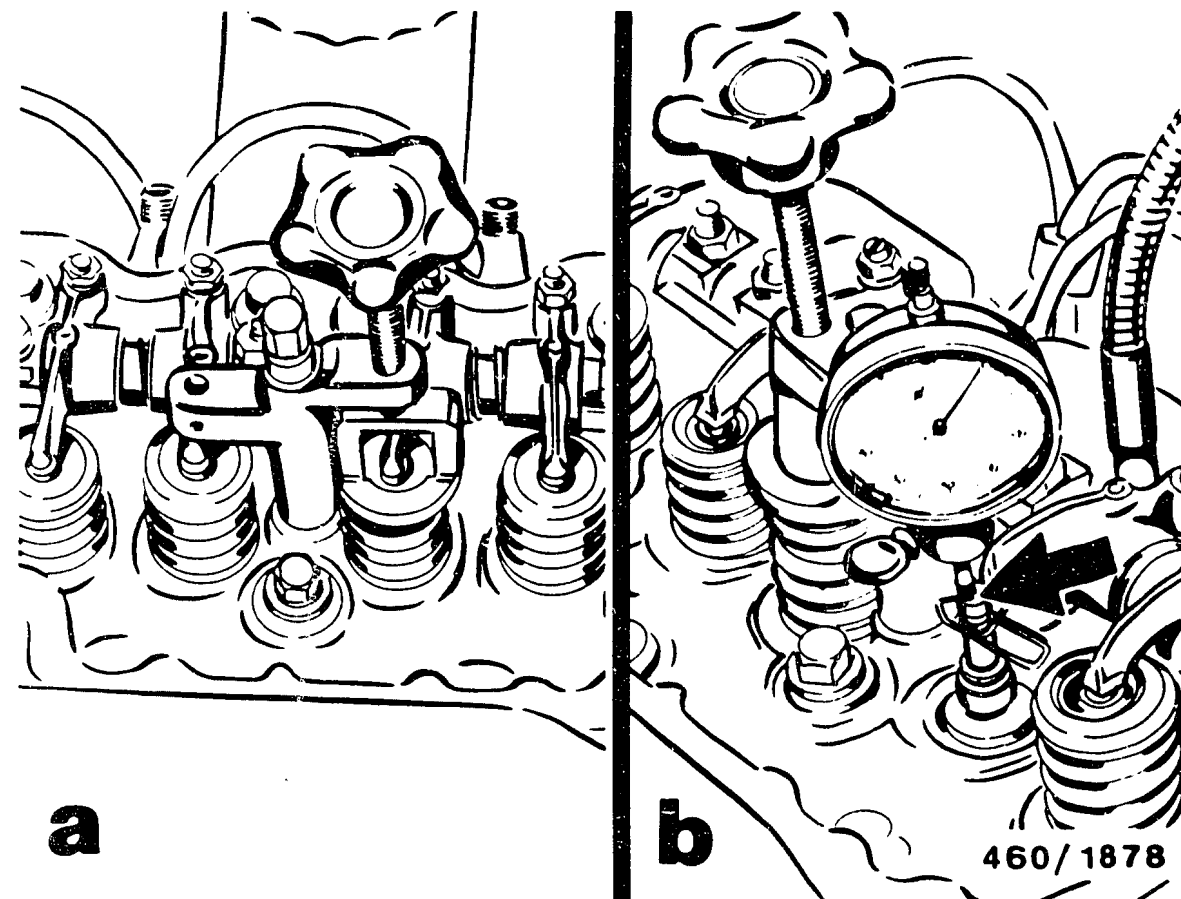


Mount toothed-belt sprocket on to shaft stub and tighten nut by hand.
Set plunger of fuel-injection pump to port D.
Loosen nut 2 turns and pull toothed-belt sprocket against the nut.

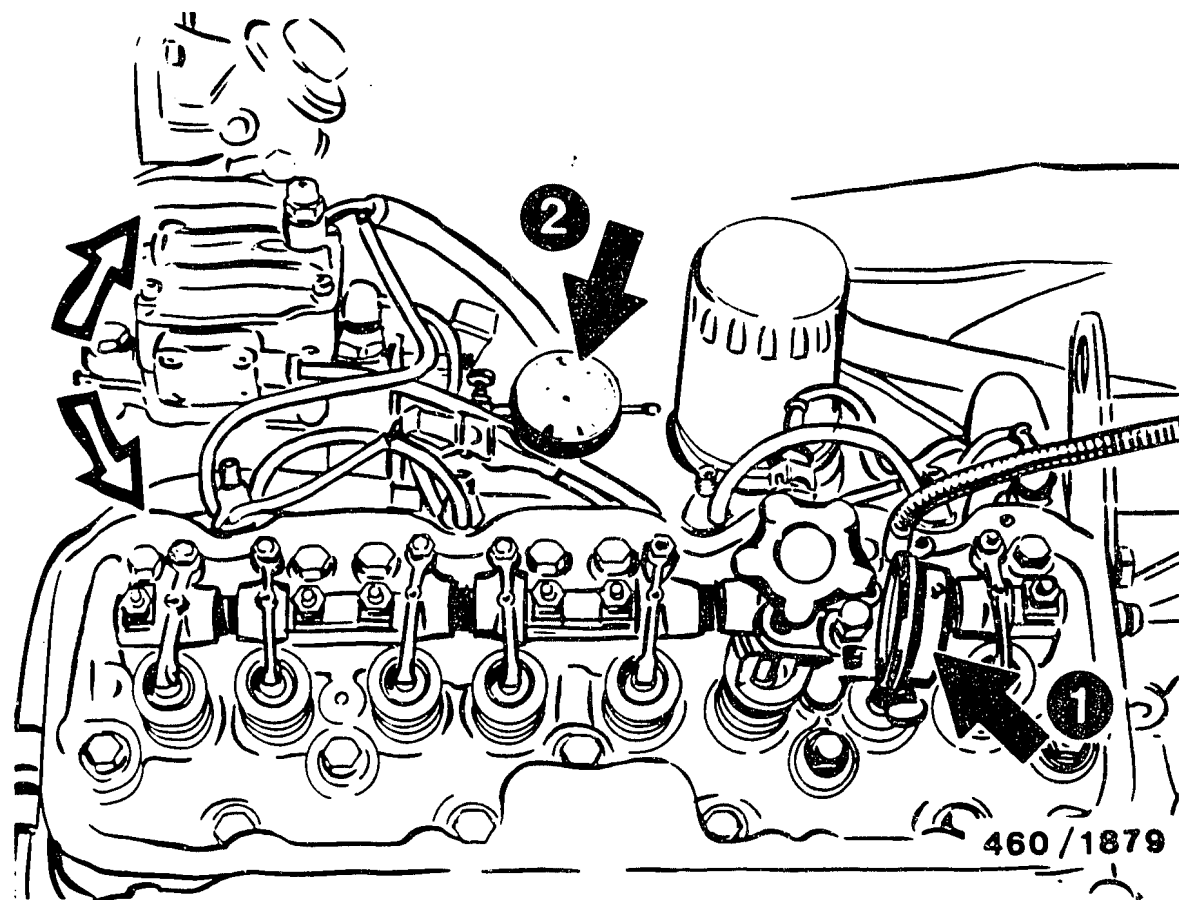
Fit toothed belt and tension with tensioning roller.
Tighten tensioning roller. Crank engine 2 turns in direction of rotation. Loosen tensioning roller and tighten it again (picture a, arrow).

Remove cylinder head cover.

Remove bleeder screw, fit KDEP 1185 with dial indicator (picture b, arrow).

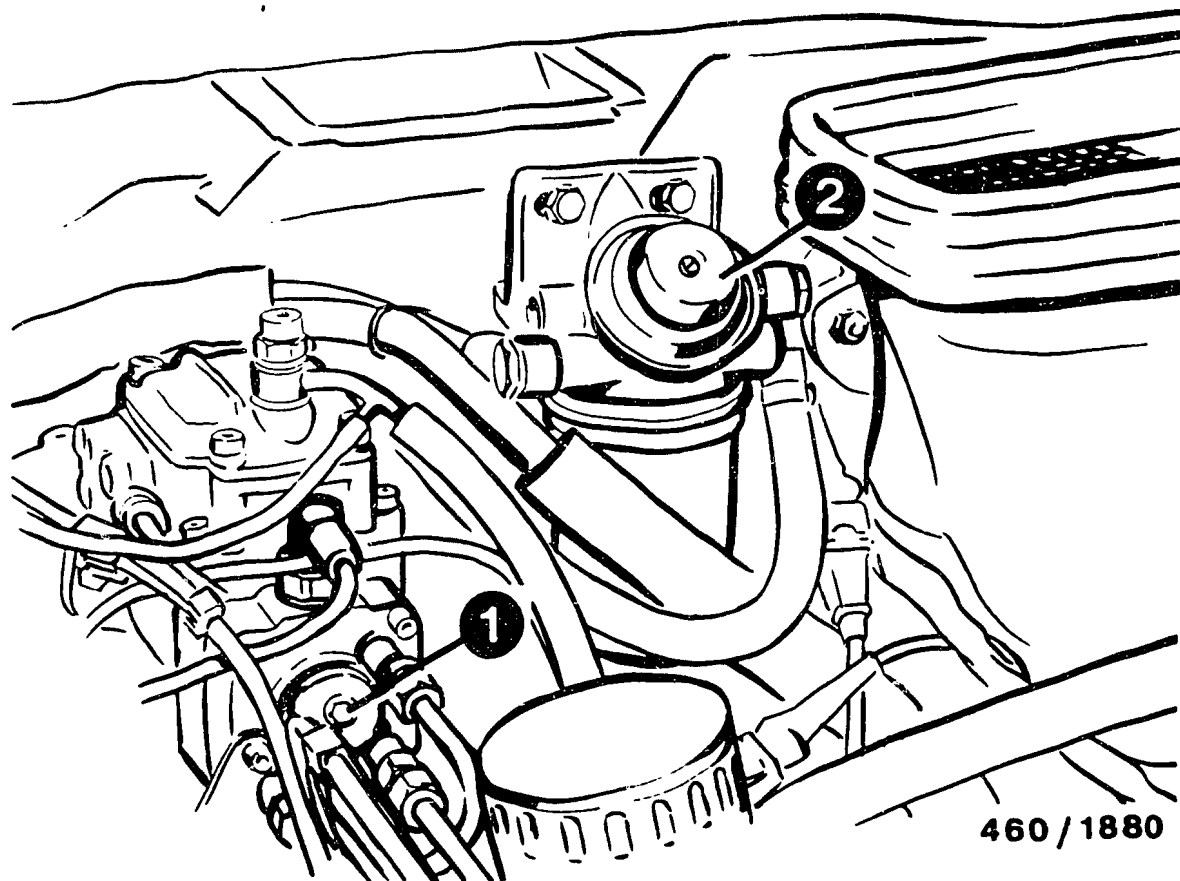


Cylinder no. 1 at TDC; cylinder no. 4 on valve overlap.
Use combined removal and measuring tool (Citroen 5003-T.A.) to remove valve spring (picture a).
Push rocker arm to the right as far as it will go and fix it in this position.
Lower valve on to piston and secure against falling through. Insert dial indicator in measuring tool and pretension approx. 10 mm. Dial indicator drive should be on sliding surface of valve (picture b, arrow).



Turn engine over one quarter of a turn in direction opposite to direction of rotation.
 Pretension dial indicator (2) approx. 2 mm and set it to zero.
 Turn engine over in direction of rotation until dial indicator (1) indicates a maximum value. Set dial indicator to zero.
 Repeat procedure.
 Set valve to setting indicated in brief instructions.
 Assign fuel-injection pump to engine by swivelling it.
 Refer to brief instructions for setting.

Tighten fastening nuts at fuel-injection-pump flange and fastening screws at support plate to 20 Nm.
 Remove measuring device KDEP 1085 with dial indicator at fuel-injection pump.
 Fit bleeder screw with new copper ring.
 Set cylinder no. 1 piston to TDC.
 Remove dial indicator, fit valve spring.
 Remove tool (Citroen 5003-T.A.).
 Move rocker arm back to its original position, set valve clearance (refer to brief instructions for setting).
 Fit cylinder head cover.
 Fit fuel supply and return line (inlet-union screw with overflow restriction) (renew copper sealing rings).
 Fit fuel-injection tubing.
 Vent fuel-injection system if necessary.
 Establish plug connections (start-of-delivery solenoid valve, electric shutoff unit, 7-pole plug connection).



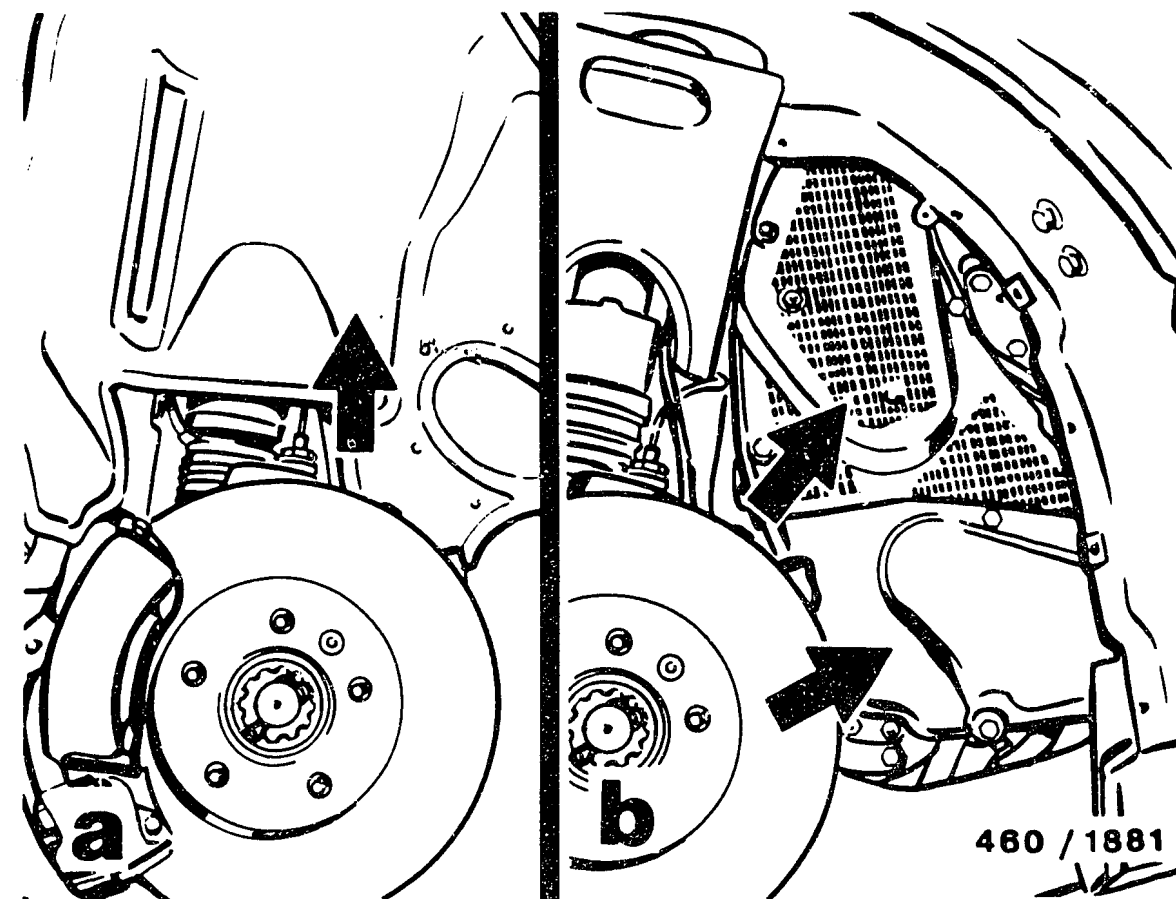
- 1 = Bleeder screw
2 = Hand pump

BLEEDING FUEL SYSTEM

Loosen bleeder screw and actuate hand pump until there are no bubbles in fuel as it emerges.

Tighten bleeder screw.

Actuate hand pump again until resistance is felt.



TESTING AND ADJUSTING ENGINE MANAGEMENT

Testing engine management

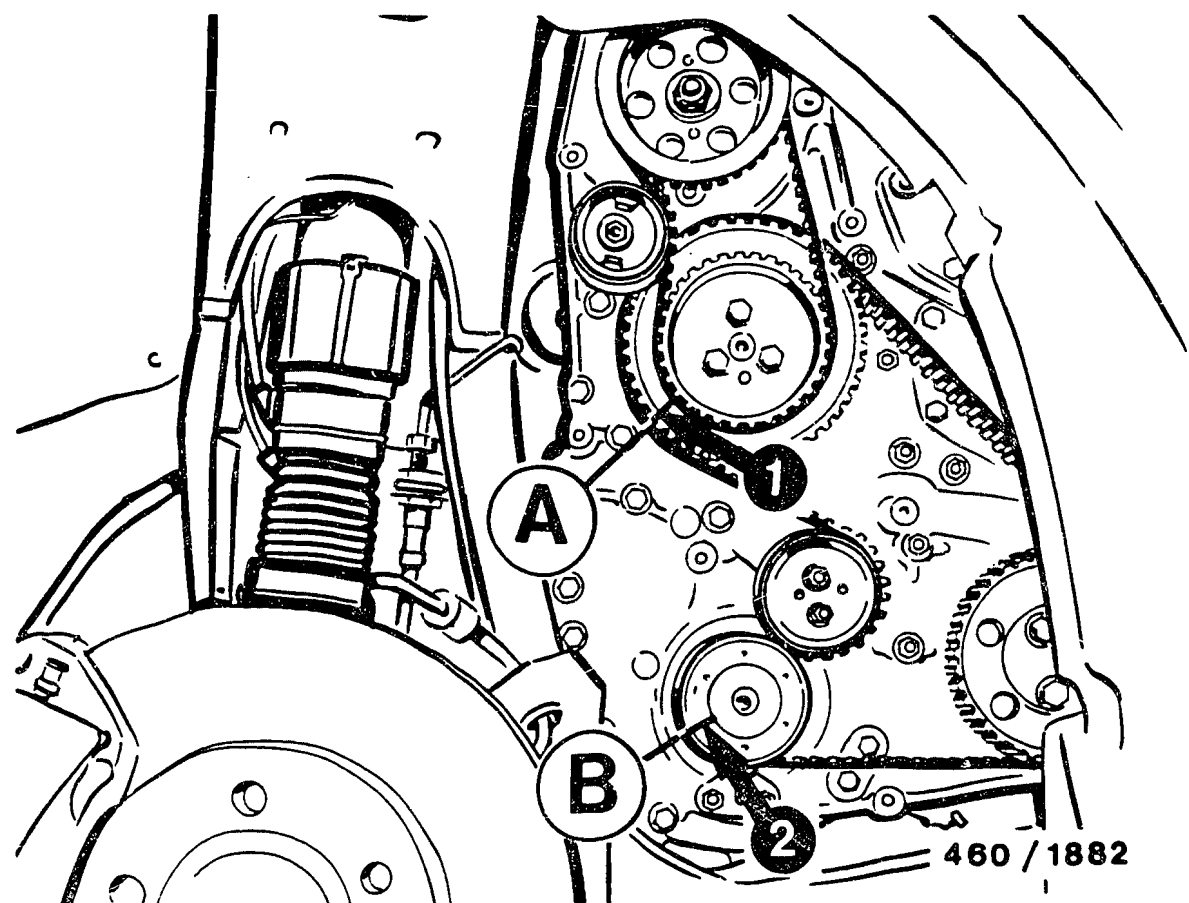
Detach ground cable from battery.

Jack up vehicle at front (caution! only apply jack at locations envisaged) and provide support on right-hand side with chock.

Engage 5th gear.

Remove trim in wheel housing (picture a, arrow).

Remove toothed belt covers (picture b, arrows).



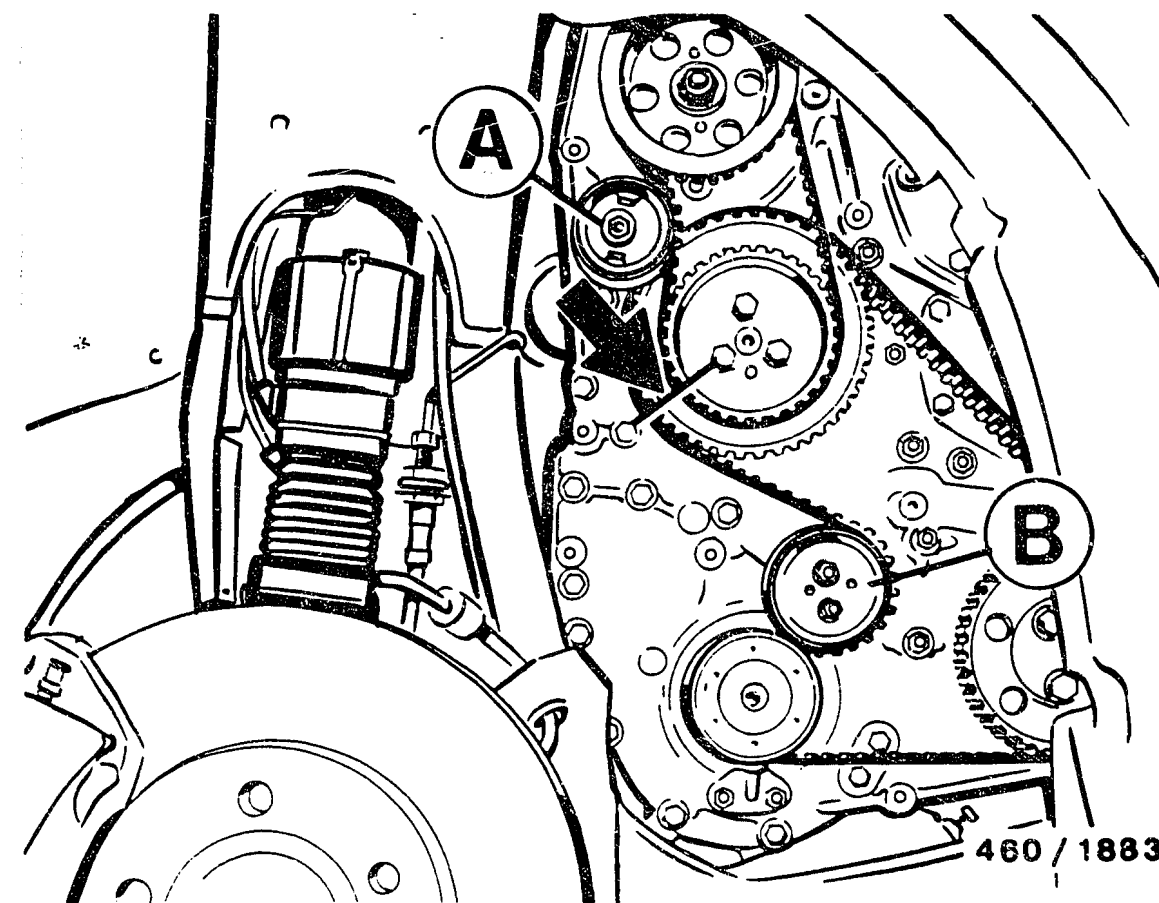
Crank engine in direction of rotation until the marks listed below coincide:

- * Mark (A) on toothed belt with mark (1) on belt sprocket
- * Mark (B) on toothed belt with mark (2) on belt sprocket.

There are 35 teeth between the marks on the toothed belt (short distance between marks on toothed belt).

Adjust engine management if marks do not coincide.

- * Fit toothed belt covers if marks do coincide.
- * Attach trim in wheel housing.



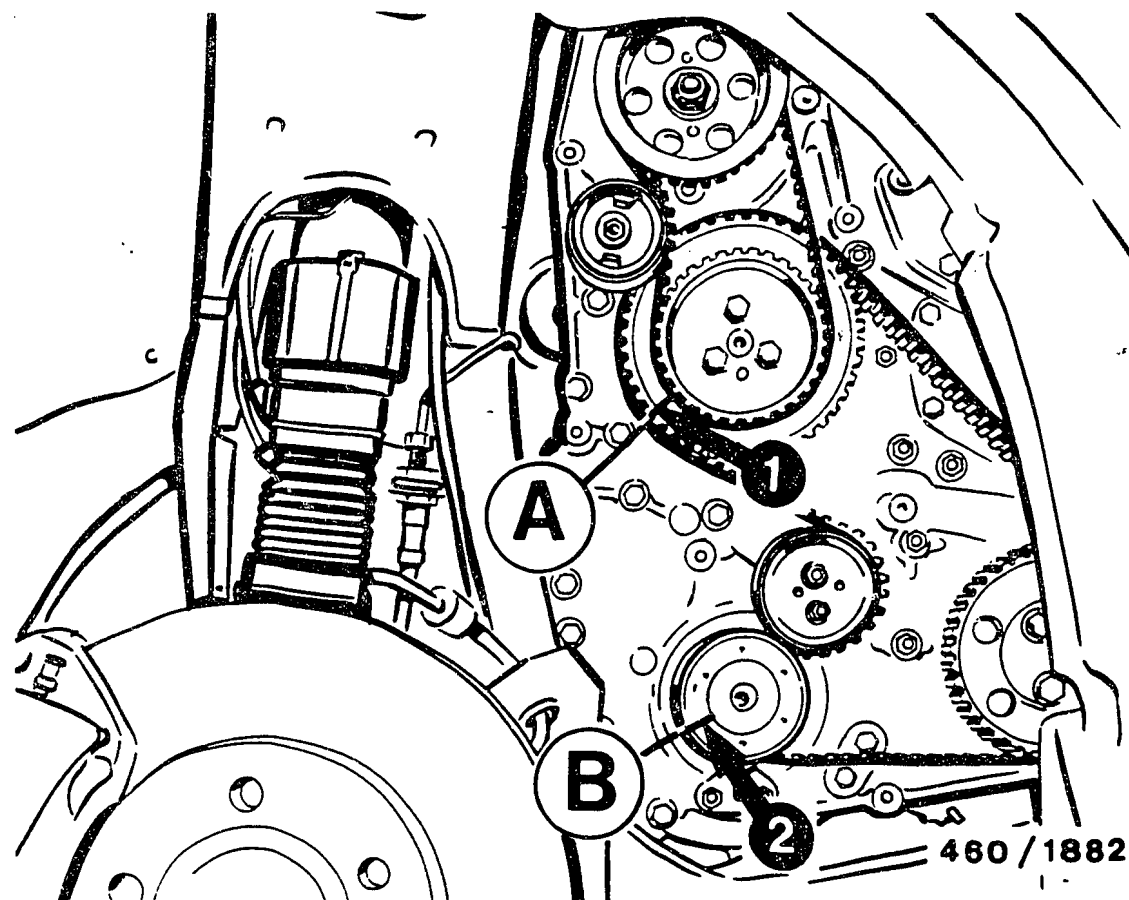
Adjusting engine management

Mark position of toothed belt of fuel-injection-pump drive (marks are to be made on both belt pulleys, on tension side of toothed belt).

Remove belt tensioner from toothed belt of fuel-injection-pump drive (picture, a).
Remove toothed belt.

Cause mark on camshaft sprocket to coincide with center of screw (picture, arrow).

Loosen belt tensioner of engine-management toothed belt and remove toothed belt (picture, b).

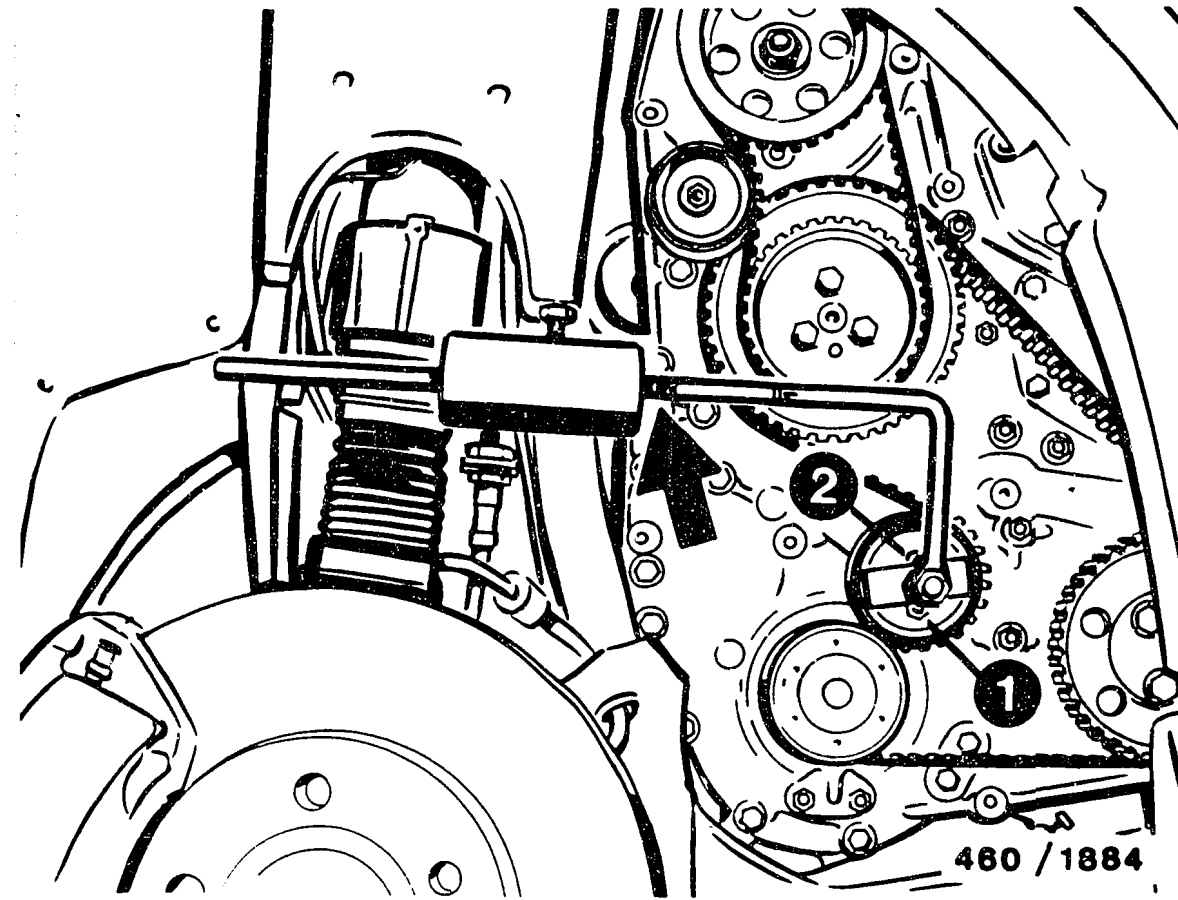


Move belt pulleys into position where marks on toothed belt coincide with marks on belt pulleys.

- * Mark (A) on toothed belt with mark (1) on belt sprocket
- * Mark (B) on toothed belt with mark (2) on belt sprocket.

There are 35 teeth between the marks on the toothed belt (short distance between marks on toothed belt).

Place toothed belt of fuel-injection pump in position (taking care to ensure that the marks made coincide).
Fit chain tensioner of fuel-injection-pump drive.



Attach tool -K- from tool kit OUT 206 028T to tensioning roller.
Position weight on 2nd mark and secure it (picture, arrow).
Tighten M8 nut to 20 Nm and M10 nut to 32 Nm (picture, 1).

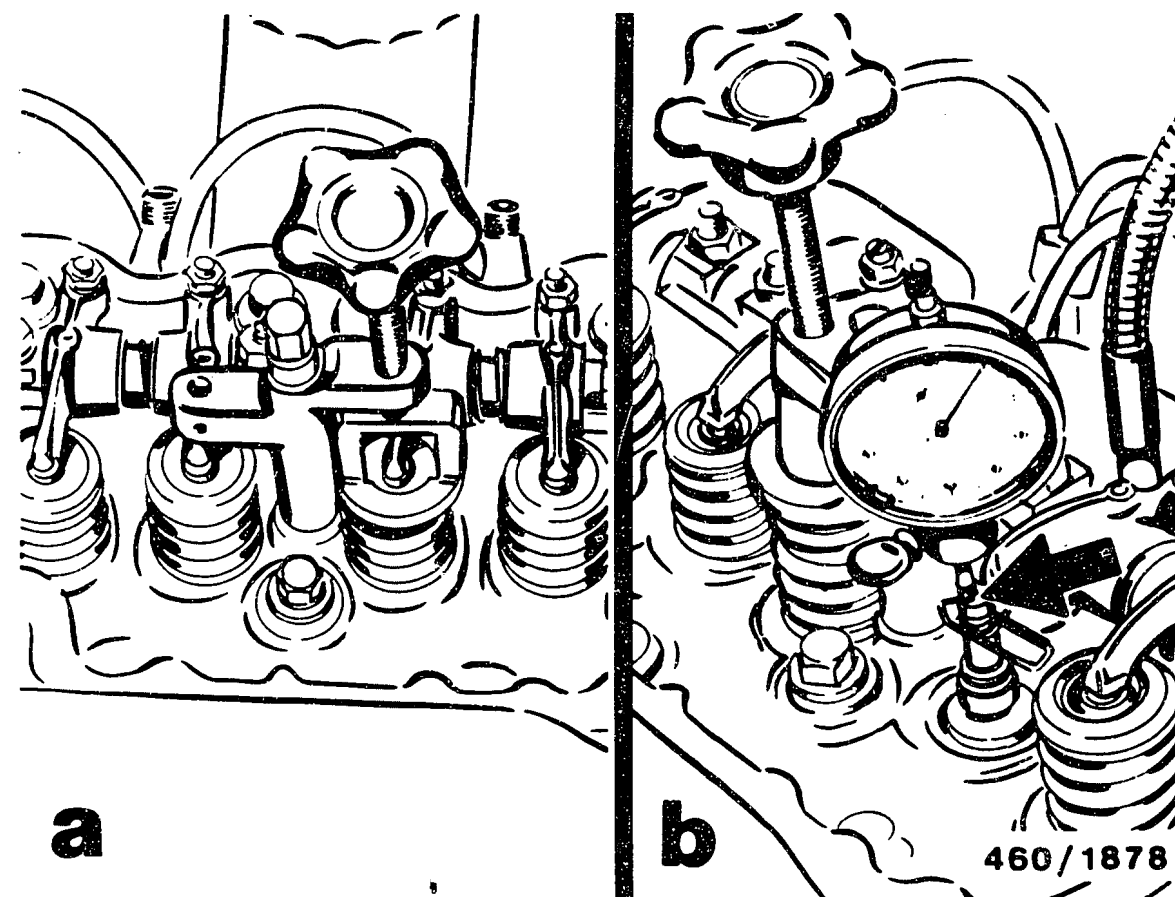
Start engine and allow it to warm up until cooling fans cut in.

Cause marks on toothed belt to coincide with marks on belt pulleys.
Turn crankshaft one quarter of a turn in direction opposite to direction of rotation.
Loosen nuts (picture, 1), mount tool -K- on tensioning roller and check that it can move freely.
Turn crankshaft one quarter of a turn in direction of rotation.
Tighten nuts (picture, 1) with same torque.

Remove tool -K-.
Fit toothed belt covers.
Fit wheel housing cover.

Attach ground cable to battery.

Check assignment of fuel-injection pump/engine.



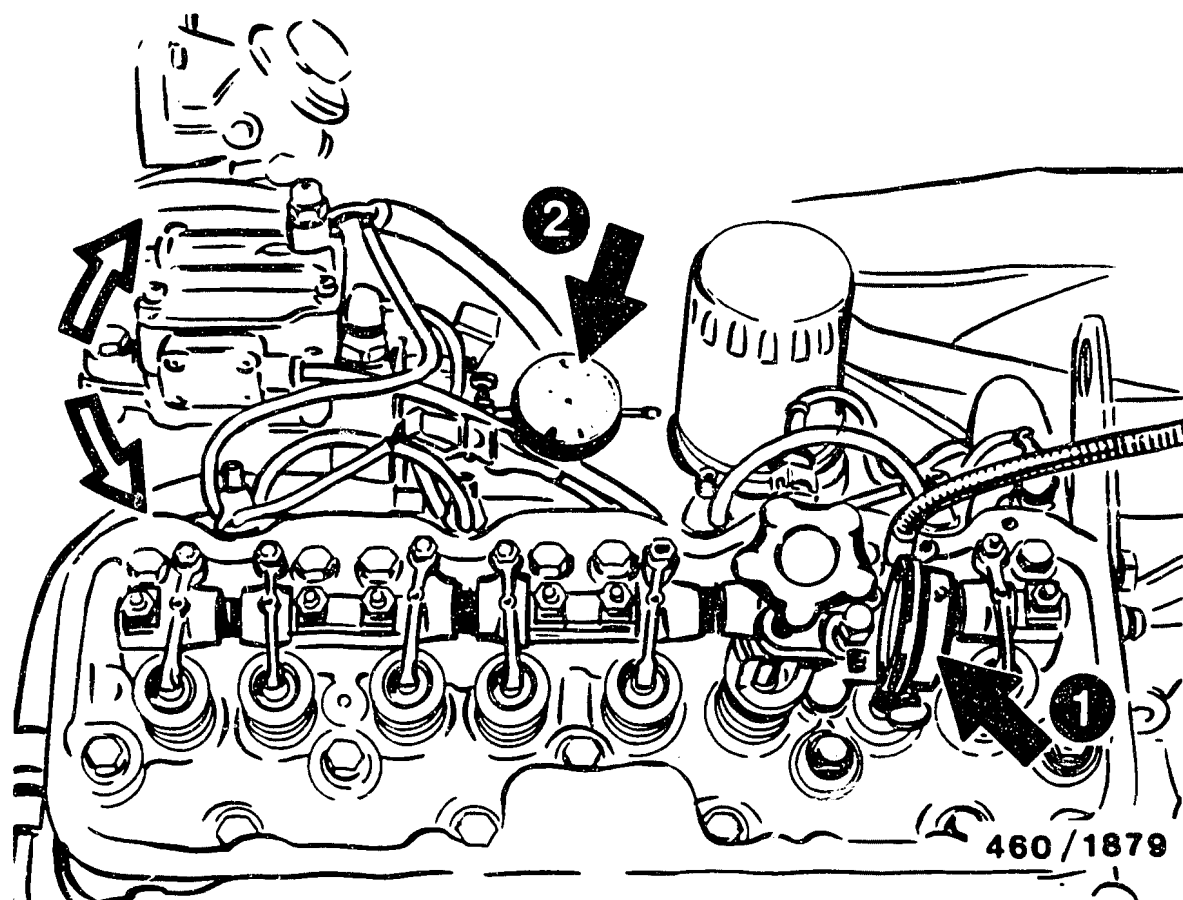
FUEL-INJECTION PUMP/ENGINE ASSIGNMENT

Detach ground cable from battery.

Jack up vehicle at front (caution! the jack must only be applied at the envisaged locations) and provide support on right-hand side with chock. Engage 5th gear.

Remove cylinder head cover.

Use free-standing driving gear to set engine to cylinder no. 1 TDC (cylinder no. 4 is on overlap).
At cylinder no. 1, use combined removal and measurement tool (Citroen 5003-T.A.) to remove valve spring of exhaust valve (picture a).
Push rocker arm to the right as far as it will go and secure it in this position.
Lower valve on to piston and secure it to prevent it falling through. Insert dial indicator in measuring tool. Dial-indicator drive should be on sliding surface of valve (picture b, arrow).



Remove bleeder screw at fuel-injection pump and insert tool KDEP 1085 with dial indicator (picture, arrow).
 Pretension dial indicator (1) approx. 10 mm.
 Turn engine over one quarter of a turn in direction opposite to direction of rotation.
 Pretension dial indicator (2) approx. 2 mm and set it to zero.

Turn engine over in direction of rotation until dial indicator (1) indicates a maximum value. Set dial indicator to zero.

Repeat procedure.

Adjust valve to required setting (refer to brief instructions). The position of the pump plunger must attain the value given in the brief instructions.

Correct the setting by swivelling the fuel-injection pump (loosen fastening nuts at fuel-injection-pump flange and screws at support plate).

Then tighten screws and nuts to 20 Nm.

Remove measuring device KDEP 1085 with dial indicator at fuel-injection pump.

Fit bleeder screw with new copper ring.

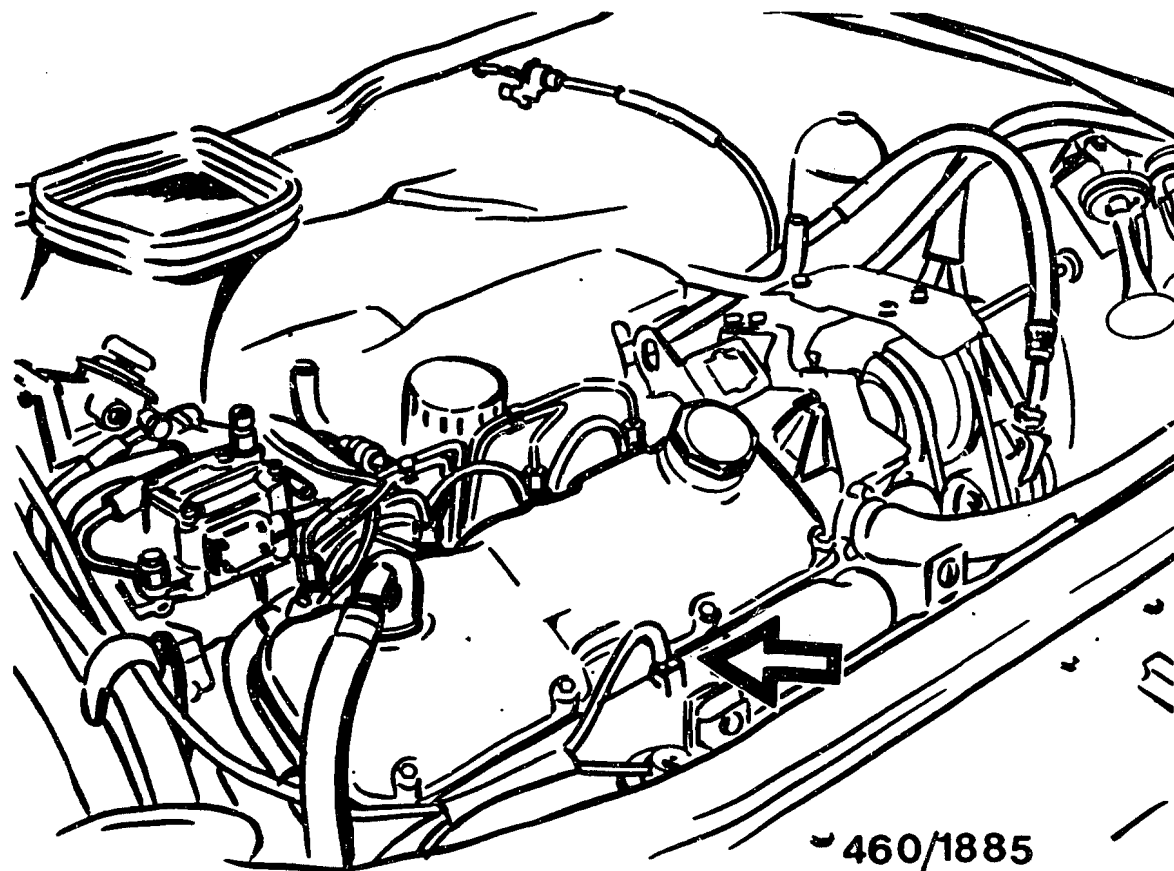
Set piston of cylinder no. 1 to TDC.

Remove dial indicator, fit valve spring.

Remove tool (Citroen 5003-T.A.).

Move rocker arm back to its original position, set valve clearance (refer to brief instructions for required value).

Fit cylinder head cover.



TESTING CHARGE-AIR PRESSURE

When working on turbocharger, it should be noted that even minute dirt particles can destroy the turbocharger.

The engine should therefore **n e v e r** be used without an air filter.

Use can be made for testing the charge-air pressure of the pressure measuring device KDJE-P 100 or a pressure gauge 0...1.6 bar (e.g. Wika No. 4184).

Note:

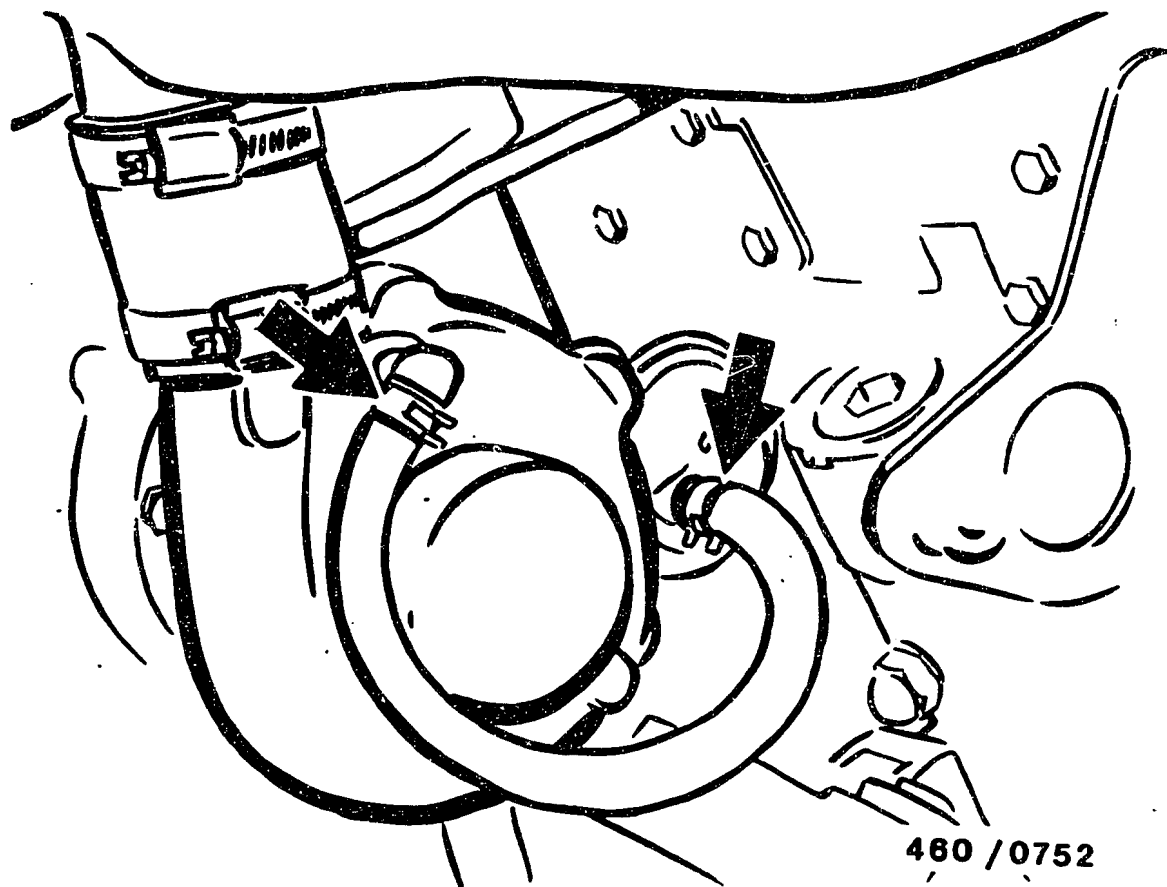
Connect respective measuring device to fitting of charge pipe (picture, arrow).

Charge-air-pressure measurement

The charge-air pressure is to be measured on a chassis dynamometer.
Refer to brief instructions for set value.

Note:

The following are prerequisites as regards assessment of the exhaust turbo-supercharger: correctly adjusted start of delivery and nozzle opening pressure, no leakages on intake and exhaust end, engine in perfect mechanical working order (valve clearance, compression).



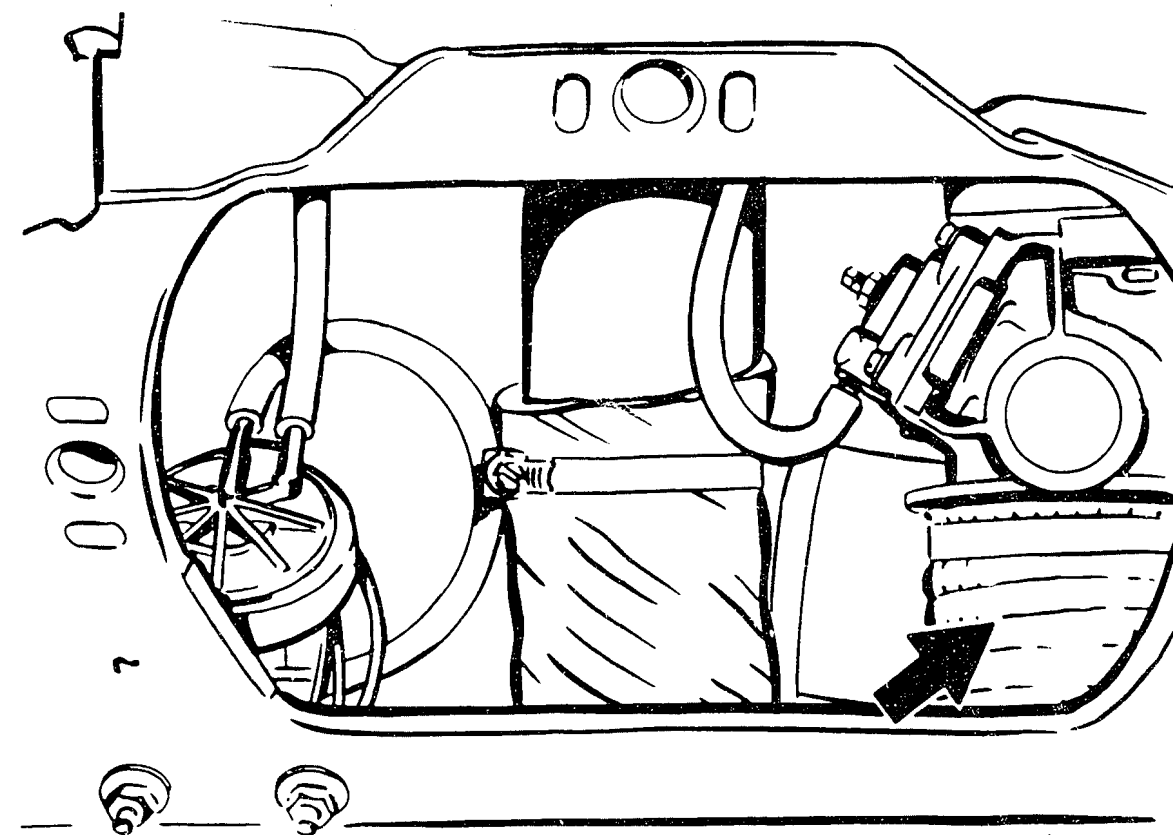
Excessive charge-air pressure:

- * Lead to boost-pressure controller loose or defective (picture, arrows).
- * Diaphragm of boost-pressure controller (*).
- * Valve of boost-pressure controller seized, closed (*).
- * Valve of boost-pressure controller incorrectly set (*).

* = Renew exhaust turbo-supercharger.

Note:

After installing a new exhaust turbo-supercharger, top up supercharger with oil and let engine idle for approximately 1 minute, so as to ensure supply of oil to supercharger.



Inadequate charge-air pressure:

- * Seal between charge pipe and engine block leaking.
- * Connecting hose between compressor outlet and throttle valve leaking (see picture - arrows).

Further causes of inadequate charge-air pressure:

- * Air filter (clogged).
- * Boost pressure controller incorrectly set. *
- * Turbine shaft with seizure tendency. *
- * Exhaust system blocked.

* = Renew exhaust turbo-supercharger.

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For production reasons:
continued on the following
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